THE AEROPLANE and ASTRONAUTICS

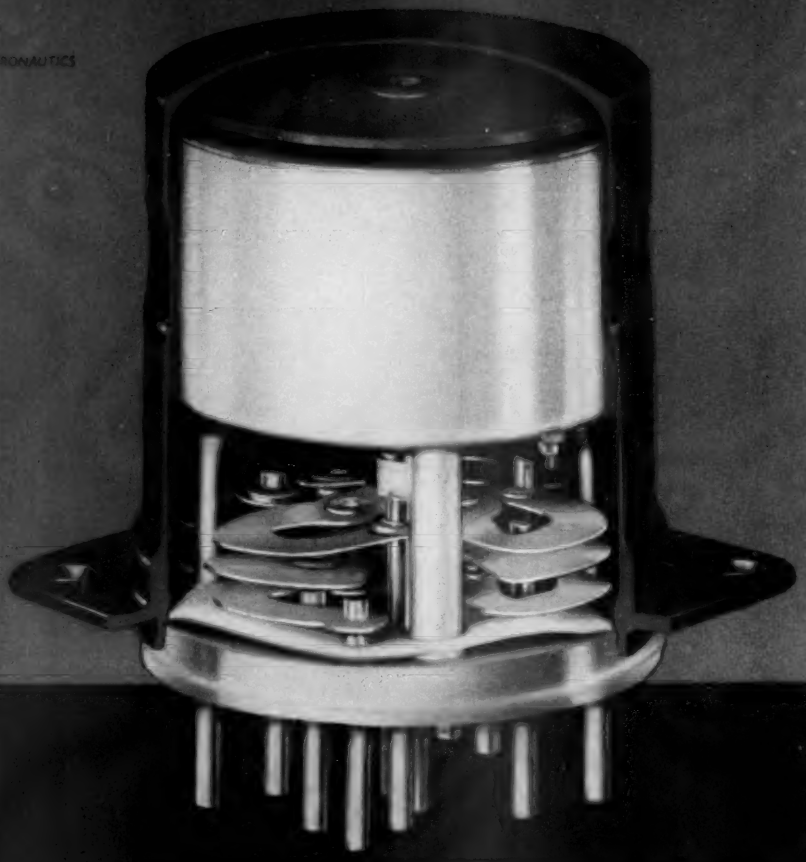
DH 125

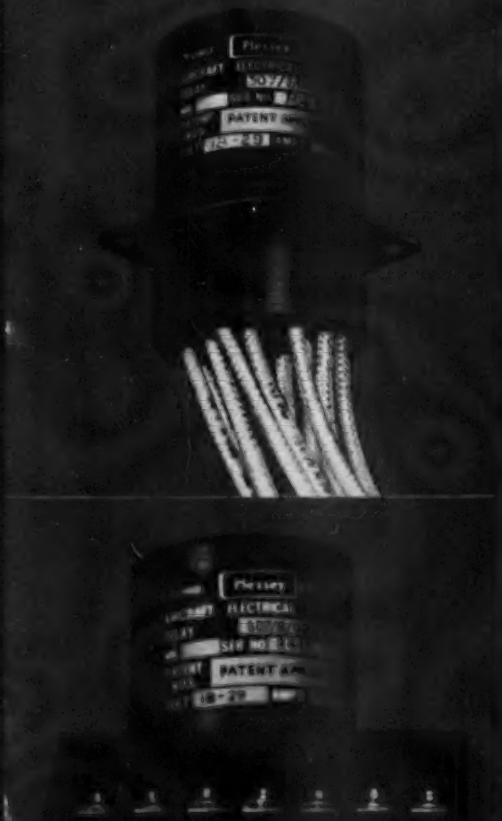
de Havilland lead the way

(Bristol Siddeley Viper jet engines)

EXECUTIVE AIRCRAFT OF THE FUTURE

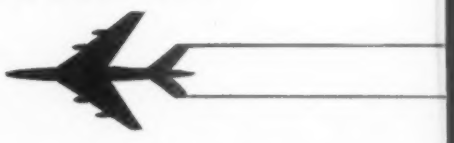
HAWKER SIDDELEY AVIATION





A NEW RANGE OF

Plessey



CYLINDRICAL RELAYS

The use of high efficiency magnets—allowing an appreciable reduction in weight and size with no sacrifice of contact pressure or clearance—is one of the latest design features incorporated in these new Plessey relays. Available for either d.c. or a.c. operation, they are hermetically sealed and avoid risk of contact contamination by three highly effective methods:—

- *Enclosing coil in a separate, sealed container.*
- *Using only inorganic materials in the contact chamber.*
- *Excluding soldering flux from the contact chamber.*

As a direct result, here is a range of relays of exceptional reliability, particularly applicable in adverse environmental conditions. Either four or six changeover contact actions are available; with plug-in, wired or screwed connectors.

For qualified engineers interested in working in this field the opportunities at Plessey are outstanding. Please contact the Personnel Officer.

THE PLESSEY COMPANY LIMITED · Aircraft and Atomic Energy Group
Aircraft Electrical Division (Relays and Control Systems Unit)
Eastern Avenue, Romford, Essex. Telephone: Seven Kings 6050
Overseas Sales Organisation: Plessey International Limited · Ilford · Essex · Telephone: Ilford 3040

A98

Beechcraft BUSINESS AEROPLANES

on display at

Baginton Airport (COVENTRY)-April 28·29·30

Short Brothers & Harland Limited

distributors of Beech business and personal aircraft in the British Isles, will be putting on display the latest models in the Beechcraft range at the Shackleton Aviation Weekend at Baginton Airport.

This display offers all forward-looking organisations the opportunity to gain first-hand knowledge and experience from trial flights and demonstrations of these fast, comfortable aircraft. Beechcraft have all-weather capability, great structural strength, high performance and low operating costs. Each aircraft is backed by the full facilities of the Short organisation, including comprehensive maintenance services and spares stocks.

The Beechcraft Queen Air

Introduced last year and already providing owners the world over with profitable and pleasurable air travel, the all-new Beechcraft Queen Air will carry eight people and their baggage at cruising speeds up to 214 mph. Maximum range, with fuel allowances, is 1,200 miles and capacity payload can be carried more than 900 miles. The Queen Air represents a major advance in business aircraft design.

The Beechcraft Travel Air

Carrying five people in individual reclining comfort, the Beechcraft Travel Air cruises at speeds up to 200 mph. It has a maximum range, with fuel allowances, of 1,250 miles, yet uses little more fuel than many single-engine business aeroplanes.

The Beechcraft Debonair

Outstanding strength, comfort and economy have quickly established the Beechcraft Debonair, introduced a year ago, as the leading aircraft in its class. With individual seating for four people, the Debonair cruises at speeds up to 185 mph and has a maximum range, with fuel allowances, of 1,000 miles.

In addition to the aircraft illustrated, the Beechcraft range includes:

BONANZA 4 seats, cruise up to 195 mph. Max. range* 1,200 miles.
BARON 5 seats, cruise up to 220 mph. Max. range* 1,200 miles.
TWIN-BONANZA 7 seats, cruise up to 223 mph. Max. range* 1,400 miles.
SUPER 18 11 seats, cruise up to 214 mph. Max. range* 1,500 miles.

**with fuel allowances*

Full information on all BEECHCRAFT aeroplanes is available from the British Isles distributors:

SHORT BROTHERS & HARLAND LIMITED

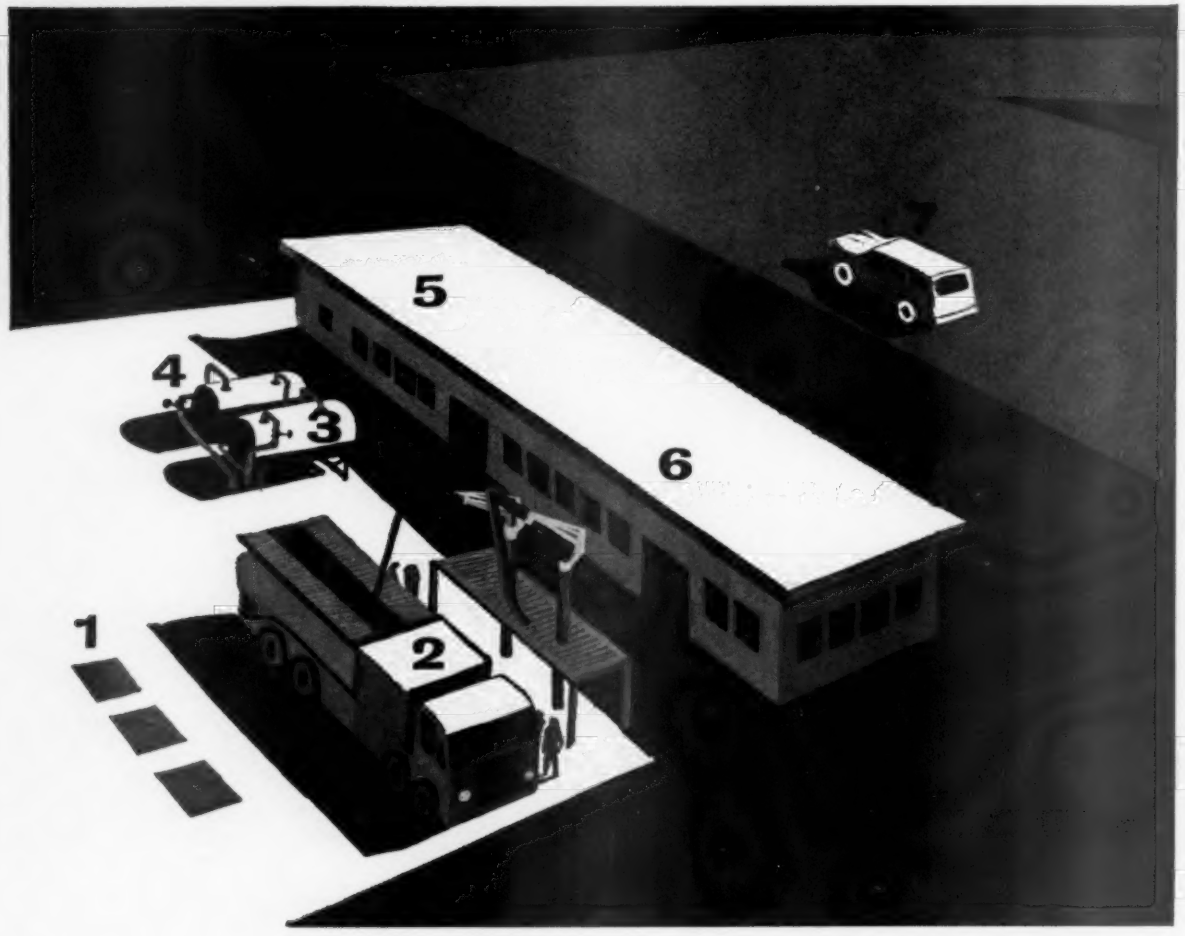
LIGHT AIRCRAFT DIVISION, QUEENS ISLAND, BELFAST, OR THE AERODROME, ROCHESTER, KENT

(Co-Distributors: Aircraft Associates Limited)

A

FUEL HANDLING

a comprehensive service by Firth Cleveland



1 Firth Cleveland Tank Gauges for airfield fuel bulk storage. (Also Gilbarco Firth Cleveland Gauges for refinery bulk tanks.)

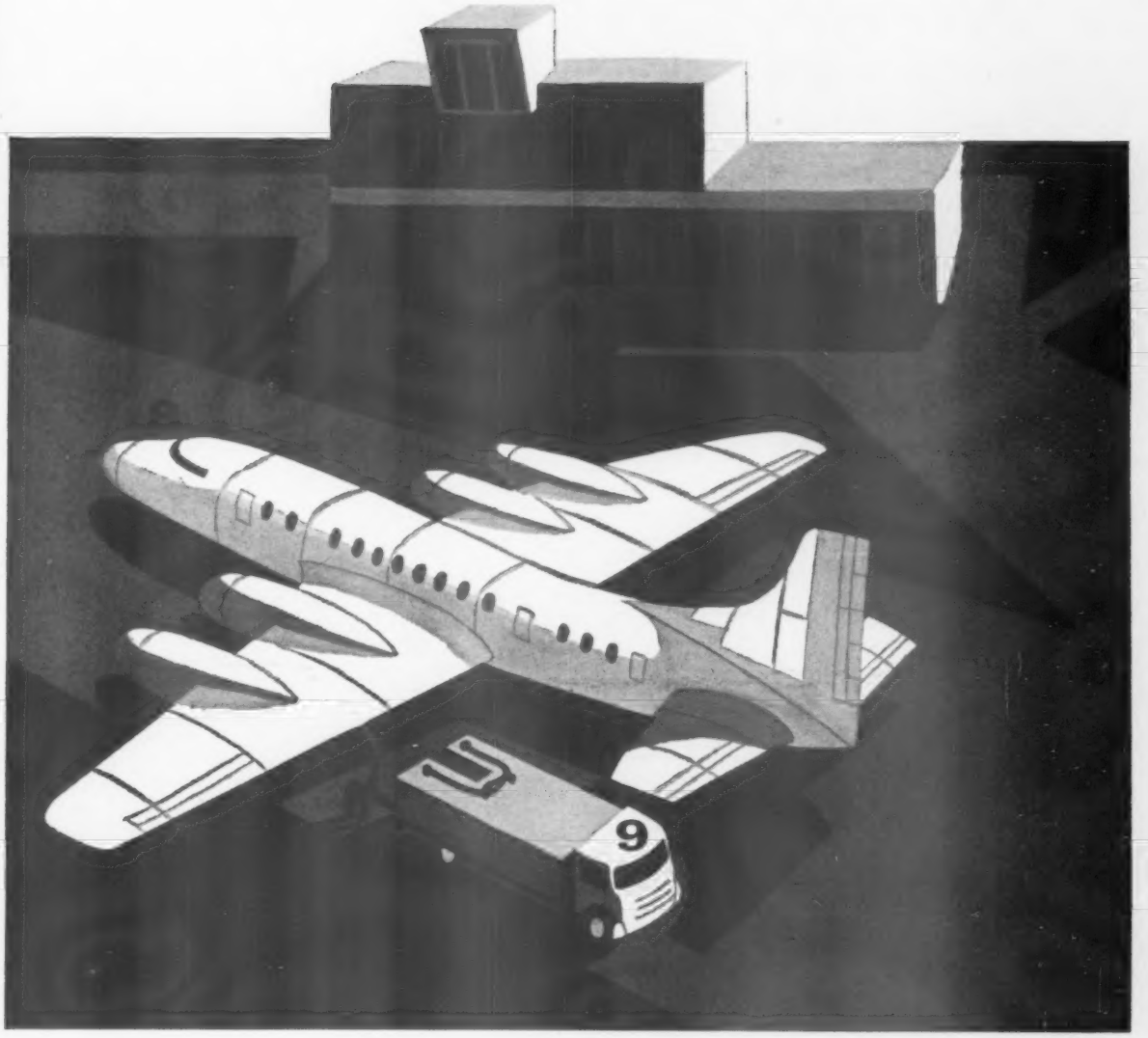
2 Simmonds Refuellers.

3 Fram Separator/Filters remove water, dirt rust and scale.

4 Simmonds Flow Control Valves and Pipeline Shock Alleviators.

Specialised equipment for handling aviation fuel at every point from bulk storage to aircraft engine—specialised equipment for filtering, pumping, controlling, metering and transporting fuel, and specialised instruments for indicating fuel quantities and rates of flow. Our products ensure speedy, smooth and safe delivery of fuel to the aircraft in clean, and waterfree condition.

Simmonds Aerocessories Ltd./Firth Cleveland Instruments Ltd.



5 Fram Filters and Strainers for pump protection

6 Firth Cleveland Self-priming Centrifugal Pumps.

7 Firth Cleveland Service Vehicles.

8 Firth Cleveland Aircraft Flowmeters. Pacitor Fuel Gauges.

9 Simmonds Fuel Dispenser Vehicles for hydrant system refuelling.

Firth Cleveland have an established Service Organisation for regular maintenance of their fuel handling equipment. Qualified Service Engineers, based throughout the country, are available to inspect and maintain this equipment on airports and military airfields, at fuel depots and refineries and on other installations in all parts of the United Kingdom.

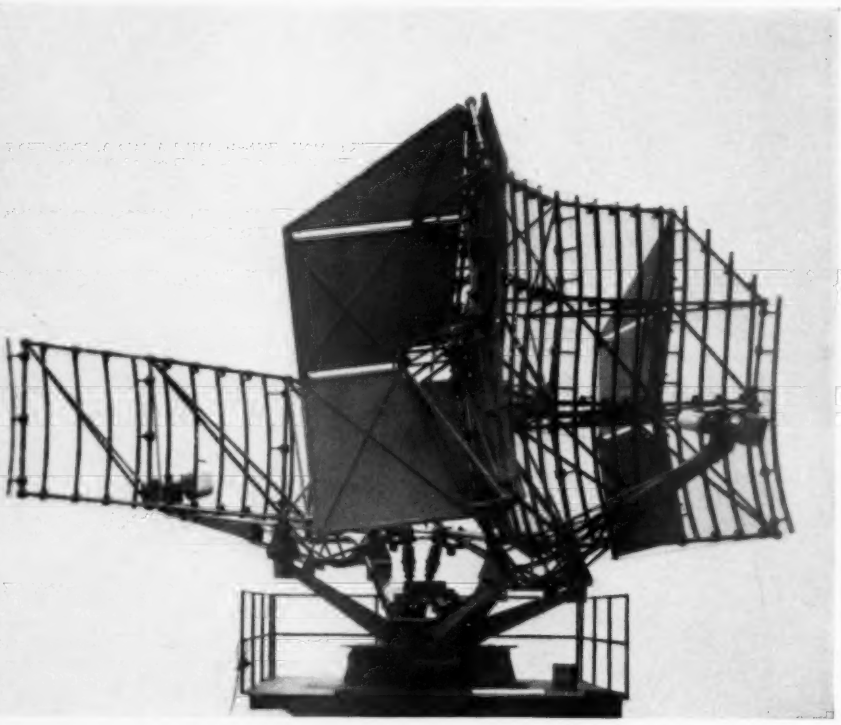
7 Cleveland Row, London, S.W.1. Telephone: WHitehall 3100

MEMBERS OF THE FIRTH CLEVELAND GROUP

CEC/C1

DASR-1

THE OUTSTANDING RADAR FOR THE JET AGE



DASR-1 incorporates these outstanding 10 cm. features:—

- Absolutely constant and gap-free coverage through 360°.
- High discrimination at all ranges out to the maximum.
- A high data rate continuously maintained.
- Reduction of siting limitations due to ground reflections.
- A highly effective, fail-safe permanent echo suppression system without blind speeds.
- Sustained high performance in bad weather conditions provided by the most advanced circular polarisation system yet developed.
- A large measure of built-in 'stand-by' facility.

Surveillance Radar with solid gap-free coverage

DECCA RADAR DECCA RADAR LIMITED · LONDON · ENGLAND

DR157

***LIGHTERAGE BY AIR*—Demonstrating its versatility as a cargo carrier, Sikorsky's S-60 *Skycrane* recently lifted a cargo container from the hold of a ship at sea; minutes later placed it in a truck ashore. The S-60 can carry five tons. The next *Skycrane*, the turbine-powered S-64, will lift up to ten tons. Future designs will carry up to 40 tons. Transporting loads by cargo hook or complete units in pre-loaded pods, the *Skycrane* is easily adapted to a multiplicity of military and industrial uses.**

UNITED AIRCRAFT INTERNATIONAL

East Hartford 8, Connecticut, U.S.A.

HAMILTON STANDARD · SIKORSKY · NORDEN

European Headquarters: 3/5 Warwick House Street, London S.W. 1, England

Interplanetary Flight

An Introduction to Astronautics By ARTHUR C. CLARKE

INTERPLANETARY FLIGHT is both a lucid introduction to the new science of astronautics and an exciting survey of the possibilities and problems of space travel.

Recent spectacular developments in the field of astronautics, many of them accurately predicted by the author in the first edition, are now recorded in this new edition, which also contains a new chapter on Earth Satellites and Lunar Probes, new illustrations and a comprehensive index.

From reviews of the first edition :

"Remarkably comprehensive, exciting and persuasive."
—The Times Weekly.

"The text is authoritative and is written throughout in the author's energetic style, so well suited to the needs of the general reader as to make the development of a technical argument an exciting mental adventure."
—British Interplanetary Society Journal.

2nd Edition $8\frac{3}{8} \times 5\frac{1}{8}$ *in.* 160 *pp.* *Illustrated* *Fabroleen Boards*

12s. 6d. net from booksellers or 13s. 2d. by post from the publishers

TEMPLE PRESS BOOKS, Bowling Green Lane, London, E.C.1

Jeppesen
INTERNATIONAL
AIRWAY MANUAL
SERVICES
Avigation Products
Jeppesen & CO. GMBH.
FRANKFURT/MAIN KAISERSTRASSE 72 GERMANY
DENVER, Colorado USA

Mail this coupon for free catalogue

Jeppesen & CO., GmbH / Frankfurt/Main, Germany
Kaiserstrasse 72

Name.....

Address.....

..FOR A DRIP-PAST A

GENUINE Jubilee
REGD. TRADE MARK
WORM DRIVE HOSE
CLIP
The Finest Clip in the World

COMPANION ACCESSORY TO THE WORLD'S FINEST CLIP

L. ROBINSON & CO. (Gillingham) LTD.
LONDON CHAMBERS, GILLINGHAM, KENT TEL: 51182/3

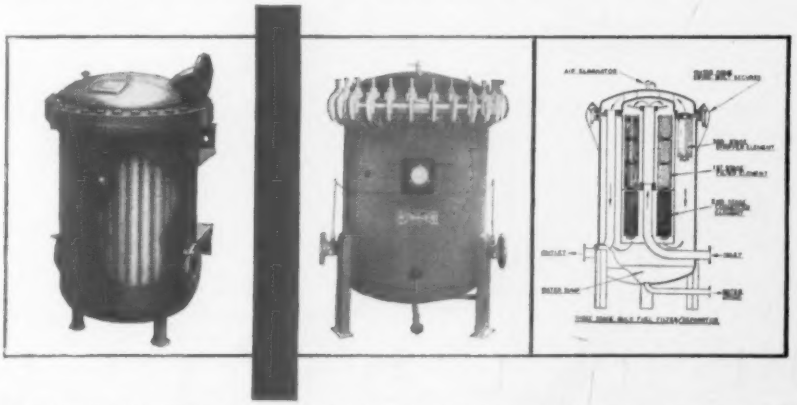
Guaranteed removal of solid impurities and water

Clean aviation fuel, essential for absolute security in flight, is guaranteed by the use of Stream-Line filter equipment which combines the removal of solid impurities with the elimination of finely dispersed water.

The Stream-Line type K filter (illustrated below left) achieves an extremely high efficiency by passing the fuel through specially prepared paper discs compressed by springs and mounted on metal rods; solid impurities are left at the edges of the discs. Any water present causes the paper to swell, with a consequent increase of back pressure which gives an indication that servicing is needed.

The Stream-Line three stage filter/water separator (illustrated below right) is designed to remove solid impurities plus free and suspended water from large quantities of fuel. The first stage removes solid particles by means of cylindrically formed pleated elements of resin impregnated paper, silicone-treated to improve wet strength. In the second stage cylindrically formed pleated elements using bonded glass fibres enable finely divided droplets of water to coalesce into larger drops which can then be easily removed. A similar process, with elements made from fine woven nylon water-repellent fabric, is used in the third stage to remove the very small percentage of finely suspended droplets carried over from the second stage.

Other Stream-Line equipment (not illustrated) used for the filtration of aviation fuel include a monitor which continuously samples the flow of fuel for the presence of water and the high output MC filter which gives an acceptable filtration efficiency at a much higher flow rate than the K type.



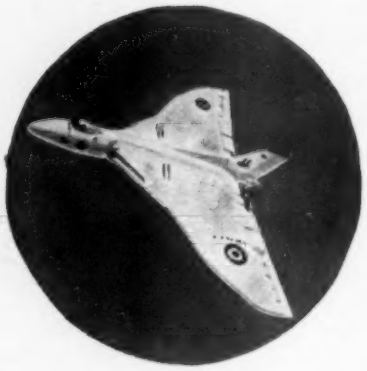
STREAM-LINE

For further information please write for a fully illustrated leaflet or if you have any specific problem in this highly specialised field our research and development department will be glad to help you.

STREAM-LINE FILTERS LIMITED · HENLEY PARK · NORMANDY · NR. GUILDFORD · SURREY

Telephone: Normandy (Surrey) 3311-3. Telegrams: Edgefilt, Guildford. A member of the VOKES Group.

SF. 110



NO TIME OVER THE TARGET! No longer need bomber aircraft penetrate deeply into heavily defended areas. The Avro " Stand-off " bomb enables a target to be destroyed while the parent aircraft is returning to its base. V-bombers, armed with this air-launched weapon, are given new flexibility and striking power — greatly reinforcing Britain's deterrent strength. **HAWKER SIDDELEY AVIATION**

32 Duke Street, St. James's, London, S.W.1.

THE AEROPLANE and ASTRONAUTICS

VOLUME 100 NUMBER 2583 APRIL 20, 1961

Paupers in Space

Major Yuri Gagarin is no Columbus. Unknown when we went to press last week, this young Soviet Air Force officer today owns, as the result of a campaign launched with the whole weight of the Russian propaganda machine behind it, the most widely known features in the World. It is certainly a change to have such a wholesome character put forward as a teenage idol.

As a technical magazine, for many years interested in the practicability of man's exploration of space, it is no function of ours to discuss the reasons behind the decision of the Russian political potentates to make a youth hero of Gagarin. It is true that the reasons do not seem far to seek, but it is more appropriate for us to remark upon the paucity of the facts needed to launch the legend. And as with all legends, however securely founded on fact, the attributed sayings and reported deeds are far from being mutually sustaining.

In our account of the Soviet achievement we have been at pains to limit our account to a statement of the facts and to consideration of other established relevant information. There have been printed far too many commentaries and pontifications about what is going to happen next.

As we have said, the gallant Russian major is no Columbus. He is no individualist driving mutinous crews to discover a new world. He is, by contrast, the carefully selected and painstakingly trained athlete chosen to spearhead the efforts of devoted teams of scientists and technicians who have been working for years towards the ends laid down a long time ago in the Soviets' multi-year plan for scientific development. Man's entry into orbit was implicit in the launching of the first Sputnik and manifestly certain in the recovery of the two dogs Strelka and Belka. Such happenings must now be seen by all to be part of the work of vast teams whose very existence has hardly been acknowledged. There seems to be a conspicuous gap between their activities and those of the distinguished Russian scientists who are seen and heard at European Space gatherings.

* * *

As we have observed, a minimal announcement of facts has been needed for the successful launching of the most spectacular flood of propaganda ever let loose on the World. The time and date but not the place of launching, the weight of the satellite, the time of passing over certain continents (not a very precise form of location) with at least one palpable discrepancy, the time of firing the retro-rocket and the time of landing were about all that was considered necessary. Observation of the Earth's appearance has been bedevilled by conflicting reports of the means used to make the observation. Against these few facts no exact account of the landing was thought necessary. Indeed the World was regaled with a variety of accounts: according to some the major stepped unaided from the "Vostok": in others he came down by parachute: some said he was in a light blue flying suit, others that it was red. True, photographs issued later on showed him in a space helmet and at the top of steps assumed to be at the base of the rocket gantry.

Of corroborative evidence little has been heard. If ever there was a case for official observation by the F.A.I., this was it! There was one statement from the United States that NASA had tracked the flight of the "Vostok." It would have been an even more dispiriting day for the U.S. if their intelligence services had failed to do this. Increasingly, the survival of the Free World depends on the ability

Editor - - - - THURSTAN JAMES
Deputy Editor - - - - F. T. MEACOCK
Founder Editor (1911-1939) *C. G. Grey*

Proprietors - - TEMPLE PRESS LIMITED
Chairman and Managing Director:
ROLAND E. DANGERFIELD

Editorial, Advertisement and Publishing Offices:
BOWLING GREEN LANE, LONDON, E.C.1

Telephone: TERminus 3636
Telegrams: "Pressimus London Telex"
Telex: 23839

Annual Subscription Rate: United Kingdom £4 15 0
Overseas £5 Canada and U.S.A. $15.00

©Temple Press Limited, 1961. The proprietors will consider any written requests to reproduce articles and illustrations appearing in this journal. Comment and brief extracts which acknowledge *The Aeroplane and Astronautics* are permissible.

of its radar surveillance installations to provide accurate account of all that goes on in what we might call orbital space; that is the space but a few hundred miles out from the Earth's surface. In all the near hysteria it is as well to remember that "space" is but a fragment of the universe.

Most speculation about the reasons behind the Russians' secrecy is likely to conclude that they are military. The gigantic Russian rockets were devised to carry hydrogen warheads and as such may be regarded as operational. Hence the location of their launching sites and details of their appearance and operation are military secrets. Most people will accept this just as they will accept the strategic advantages of being able to put trained members of an air force into space. We say most people. The devastating thought is that apparently none of our military planners does. Otherwise how could the Government be content to spend the derisory amount of one and threepence a year per head of the population on a space programme?

Matters of Moment

No Time to Waste

STIMULATING views on the latest Russian space feat have been sent to us by Mr. A. V. Cleaver, F.R.Ae.S., F.B.I.S., former chairman of the British Interplanetary Society and well known as a member of the A.R.C. and G.T.C.C. rocket committees. (Readers will recall his outspoken reply, in our Feb. 3 issue, to an article by Stuart Greenwood concerning Britain's future efforts in space.) He writes:—

Obviously it is a splendid and historic achievement, for which the Russians deserve our heartiest congratulations. It is of course unfortunate that they release no details of their vehicles and techniques of recovery, etc. However, I strongly deprecate the disparaging reactions in some quarters, suggesting that their claims may be false, that their success did not occur when they said, or only after prior tragic failures, and so on. It would be wiser, and more gracious, to assume they speak the truth, at least in this scientific context. Whenever we have had a direct check on their statements they have been correct, and I believe they were in the present instance.

As for the British position, I would not wish to change anything I wrote in reply to Greenwood. I still believe that anyone who opposes British participation in space-vehicle development is guilty, even if with the best intentions, of a grave disservice to the future of our country. Because we are at least five years behind in the space race, and because we can never hope to keep up *in all respects* with the leaders, is no valid reason for never starting at all.

Gagarin's orbital flight took place a year less one day after the Government's cancellation of Blue Streak as a weapon. The intervening period has been one of extreme frustration to all the rocket engineers and scientists in this country (not a very numerous group, even a year ago); most of all to those actually engaged on this particular project, but by implication to all their colleagues. Instead of announcing that we were still proceeding with Blue Streak, at least as a space booster, and *then* inviting European co-operation, the Government chose to make the latter a condition for going on at all.

To put it mildly, this fainthearted decision put Mr. Thorneycroft and the other British salesmen of Blue Streak at a severe initial disadvantage. Those with long memories will recall an almost identical situation, in 1956-8, with respect to another promising British rocket project, the Saunders-Roe P.177 mixed-power fighter.

The basic difficulty has always been the absence in the British "Establishment" of any real appreciation of the true importance of rocketry and space flight, an appreciation which is obviously not lacking in the U.S.S.R., or (now) in the U.S.A.

When the B.B.C. wants to interview "rocket experts," it usually produces a series of physicists, very distinguished in their own line, but who would be the last to claim any such distinction and who often suggest that putting Man into Space is an unscientific activity. (Should we replace the Royal Society by instruments and computers?) On Saturday, Apr. 15, our Astronomer Royal reiterated on a B.B.C. programme his view that space travel is "utter bilge." On Apr. 14, in a TV interview, the Prime Minister, answering a question on Britain's rôle in space, maintained (somewhat hesitantly and with less than his usual lucidity) that we were doing something about "the most important part of it"—the instrumented capsules.

To believe this is equivalent to suggesting that hydrographic survey equipment is more important than shipbuilding, the Royal Navy, and the Mercantile Marine. Our Minister for Science lectures to classical societies. A leading aircraft industrialist has told me that we should not embark on a space programme, because we could not then afford to subsidize conventional aviation projects.

Pioneer bodies like the British Interplanetary Society, and (I am glad to acknowledge) some publications like THE AEROPLANE AND ASTRONAUTICS and the Beaverbrook Press, have done their best to oppose these attitudes, but the Sandys of time are running out. What a pity the Cabinet did not listen to him.

A TV Look at Accident Investigation

LAST week's B.B.C. television semi-documentary dramatizing the work of the M.o.A.'s accident investigation department deserves mention for two reasons.

First, because—discounting two or three unimportant errors (such as the appearance, in North Country "Castleton," of a familar Hampshire brewery public house)—it was almost faultless in the aviation technical sense and thus gave a very usefully informing impression of the way in which an accident investigation works.

Secondly, because the whole thing was slanted as if to disabuse the public of some idea that Ministry accident inspectors are determined to find a pilot-error cause for every accident. The inspector allocated to the job in this case was treated somewhat cavalierly by several people—including the surviving co-pilot's wife, who seemed to be convinced that this polite and intelligent man was intent on wrecking her husband's career.

The plot hinged on the circumstances of a crash during

SECOND OFF. — The second prototype Avro 748 made its first flight at Woodford on Apr. 10. The new aircraft—seen here being prepared for its début—will now join the first prototype (which has already completed 360-odd flying hours) in the flight development programme.

Photograph copyright "The Aeroplane and Astronautics"

LYNEHAM TERMINAL.—Last Friday Air Chief Marshal Sir Thomas Pike opened this new £150,000 Transport Command air terminal at R.A.F. Lyneham.

the final stages of a GCA approach. The captain died in hospital and it looked for a while as if the co-pilot, who was flying the aircraft at the time, might be blamed. Luckily (following a passenger's evidence) a broken bracket was found to show that the port flaps had collapsed, as a result of fatigue failure, causing an uncontrollable turn to port.

The looker-in could only wish that the positive causes of all air accidents could be found so relatively quickly and easily.

Aiding Private Flying

ANNOUNCEMENT of a new fund to help private flying, presumably including gliding, will be welcomed throughout the country. Whereas the original fund which did so much good, thanks to the generosity of Lord Kemsley, had a simple title, the new one has a long-winded one and even its initials make an unpronounceable *mélange*. The official nomenclature, as announced by the S.B.A.C. is the British Aircraft Industry Fund for Private Flying in association with Shell-Mex and B.P., Ltd. The capital of £100,000 is to be subscribed by its members over three years.

Its purpose is precisely similar to that of the old Kemsley Trust in that loans will be made to approved subjects for the purchase of equipment or aircraft to promote private flying activities in this country. No doubt wherever possible the Trust will see that this is done with British products.

Arising from discussions that took place when Mr. Sandys was Minister the new fund is to be administered by Mr. Basil Meads, M.B.E., secretary of the Kemsley Flying Trust since 1947. The address will be 20a Grove Street, Wilmslow, Cheshire.

More Jet Orders

ORDERS for six additional Boeing 720s and seven Douglas DC-8s were announced last week. The Boeing orders (see page 422) were from Pacific Northern (two), Braniff (one) and Pakistan International (three 720B). Approval of the Pakistan Government for the last-mentioned purchase was announced on Apr. 17 by Air Cdre. M. Nur Khan; the first will be delivered in December this year. Boeing jetliner sales now total 370.

The Douglas order is from National Airlines, for seven of the DC-8 Series 50s with JT3D-3 turbofans. National already has three Series 20s in service. DC-8 sales now total 165.

A U.A.S. Occasion

GLASGOW UNIVERSITY AIR SQUADRON held its annual dinner on Friday, Apr. 7. Among the many distinguished guests were Capt. R. B. Laning, Captain of U.S.S. "Proteus," now in the Holy Loch, and the Commodore of Submarine Squadron 14, Capt. Norvell G. Ward. The C.O. of the Squadron, Wg. Cdr. D. M. Finn, welcomed the guests.

PROF. J. D. MACKIE, Historiographer Royal for Scotland, replying, said that it was the fashion nowadays to laugh at the British Empire and the Services, something which he personally decried. He considered the British Empire to have been one of the most civilizing influences the World had ever known—it had spread over the World a notion for fair play, justice and administrative incorruptibility.

Turning to nuclear disarmers, and particularly to those idealists who consider themselves forward-looking men, he wished that sometimes they would look backward to the two World Wars. They would see that an unprepared society cannot defend itself and that war might have been avoided on these two occasions if this country had been prepared.

The principal guest, AIR CHIEF MARSHAL THE EARL OF BANDON, in a speech not without humour, said that he began his flying career at speeds around 55 m.p.h., and in this relatively short span 1,500 m.p.h. was now almost commonplace. He had no doubt that some of the students at present in University Air Squadrons would, in their lifetime, be flying to the planets. Because of this, and also the complexity of modern flying machines, there was a greater requirement than ever before for highly intelligent young men and particularly University graduates.

The Weir Trophy, for the best all-round first year cadet, and the Aerobatic Trophy, were presented by Air Vice-Marshal H. J. Kirkpatrick, Air Officer Commanding, No. 25 Group, to Cadet Pilot D. S. A. Clavering and Act. Plt. Off. D. R. Ruddick.

A Rolls-Royce Appointment

AIR COMMODORE M. WATSON, C.B., C.B.E., was recently appointed Rolls-Royce sales representative in London. He will be based at the Rolls-Royce offices in Conduit Street.

Having joined the Royal Air Force in 1929, Air Cdre. Watson subsequently held a number of flying and technical appointments both in England and abroad during his 25 years service. He retired at his own request in 1954 when he was Director of Signals at the Air Ministry.

In 1956 he joined Rolls-Royce and for the past five years has been the company's technical representative with the Rocketdyne Division of North American Aviation Inc. in California. His duties there were mainly concerned with the rocket engine being built for Blue Streak by Rolls-Royce under an agreement with Rocketdyne.

In his new London post Air Cdre. Watson will act as a liaison link between aviation authorities in the London area and the Rolls-Royce sales organization in Derby.

A New Helicopter Powerplant

FROM Montreal comes news that a Canadian Pratt & Whitney Aircraft has completed a 50-hour test with a helicopter version of its 500-e.h.p. PT6 free-turbine engine. This turboshaft variant of the PT6 weighs only 225 lb.—which is 25 lb. less than the turboprop. The engine is the first of its type to be developed in Canada and is aimed at the light aircraft and helicopter market.

More than 1,000 hours of engine running have now been completed with the PT6 and an engine has been installed in the nose of a modified Beech 18 for flight trials. Ground-running tests have been made to check out this flying test-bed installation. The engine has already completed anti-icing tests to full military specifications at the laboratories of the Canadian National Research Council. A photograph is on page 422.

The U.S. military designation of the PT6 is the T74. In this form it has been chosen by several manufacturers involved in the U.S. Army design competition for a light observation helicopter.

The Canadian-designed PT6 is the second small gas turbine to be produced by the United Aircraft Corporation, of which the Canadian company is a subsidiary. The first was the 3,000-lb. thrust JT12, the initial design of which was shared by the Canadian company.

First studies of the PT6 began in the autumn of 1958, with detailed design starting in early 1959. The first run of a complete engine was made in February last year and in tests last December the sea-level performance guarantees were met.

The engine is only 18.5 in. in diameter. At its 500 e.h.p. take-off rating the fuel consumption is 0.69 lb./e.h.p./hr. Maximum continuous power is 450 e.h.p., with an s.f.c. of 0.71 lb./e.h.p./hr. An overhaul life of 1,000 hours is quoted.

Matters of Moment . . . .

Pilots in Livery

OVER 600 persons, members of the Guild of Air Pilots and Air Navigators and their guests, sat down at dinner at Guildhall, London, on Apr. 11 with the Grand Master, His Royal Highness The Prince Philip, Duke of Edinburgh, K.G., and the Master, Dr. K. G. Bergin, F.R.Ae.S. Chief among the guests were the Lord Mayor, Sir Bernard Waley-Cohen and the Lady Mayoress, Sheriffs and Aldermen of London.

At the conclusion of the dinner four awards were duly presented: the Cumberbatch Trophy to the R.A.F. Institute of Aviation Medicine at Farnborough, on whose behalf it was accepted by Air Cdre. W. K. Stewart; the Brackley Memorial Trophy to Capt. J. S. Shephard, A.F.C., chief pilot of Tasman Empire Airways, Ltd. (who had flown over to receive it); the Derry and Richards Memorial Medal to M. J. Lithgow, O.B.E., deputy chief test pilot of Vickers-Armstrongs (Aircraft), Ltd., which was accepted by Mrs. Lithgow in the unavoidable absence of her husband; the Award of Merit was awarded to Gp. Capt. H. A. Purvis, D.F.C., A.F.C., R.A.F. (rtd.), test pilot at the A. and A.E.E. No award was made this year of the Johnston Memorial Trophy.

Each speech was preceded by the strident notes of fanfares blown by trumpeters from the Central Band of the R.A.F., who made the rafters and the ancient stone walls vibrate.

It was a splendid occasion and in view of its five short years as a Livery Company, the Guild of Air Pilots and Air Navigators must have reflected with some satisfaction on its progress. We can recall only one other comparable aeronautical function at Guildhall and that was back in 1947. The occasion, graced though it was by so many distinguished people and their ladies, was not deemed to qualify for the full treatment and the carved alcoves that on State occasions hold the gold plate were occupied by models of aircraft, a fact which provided the Lord Mayor with an opportunity for leg pulling, which Sir George Edwards answered with a characteristic sally. The combined encounter brought forth from the Grand Master a particularly happy reference to "stick-it-together-yourself-kits." The proposal by Sir Miles Thomas that the tie for members of the ex-corporation chairmen's club should have two hardened arteries on a field of frustration is likely to cause chuckles for a long time.

The function undoubtedly established the place and scope of the Guild in the modern world of aviation. As speakers reminded those present, the Guild has no political or trade union affiliations. It is beholden only to its principles and as the Master, Dr. K. G. Bergin, said, chief among these is the responsibility to see that aviation is made safe for all the people all the time, even if these words be our gloss of the exact phrases used.

As part of the Guild's policy of establishing the highest standards it is to be noted that in the past 10 years the Guild has issued 176 Master Air Pilot's certificates. They intend to follow suit with Master Air Navigator's certificates.

A second point that was effectively established by Sir Frederick Tymms, immediate past master, was the need for a hall of the Guild's own. It needs a headquarters and as a working guild (and not by implication a historical survival) it needs them now. Of course, on such an occasion the exact means of raising funds could not be discussed, but in addition to all the facets of its work for promoting safety in the air, this is the burden that the Master and Court have to carry; this is the problem they have to solve. Considerable funds must be raised in the coming months.

End of an Industry

COMMENT in certain daily newspapers with regard to the announcement made by Herr Bruno Leuschner, president of the state planning commission of the German Democratic Republic in *Neues Deutschland* of Mar. 19, in relation to the East German aircraft industry, seems generally to have been based on a misunderstanding. What has happened, writes a correspondent who has just come back from the annual Spring Fair at Leipzig, is quite simple, and was, in fact, pretty well what might have been expected as a sequel to the recent meeting in East Berlin of the Council for Mutual Economic Aid (the Socialist bloc's counterpart to our O.E.E.C.). At that meeting, further measures were discussed and agreed by the members of the organization for the division of labour and the rationalization of production among them. It was almost a foregone conclusion that the infant aircraft industry of the German Democratic Republic would be liquidated, as has now been announced.

This industry, in East Germany's view, has served a useful purpose from a prestige point of view, by beating the West German aircraft industry to it in the production of a medium-range jet passenger aircraft, the 152. Last year's misfortune with the only prototype can hardly, from such a viewpoint,

AT GUILDHALL.—With the Grand Master, H.R.H. The Duke of Edinburgh, are L. to R. Capt. M. R. Aries, Capt. B. C. Frost, Mrs. M. R. Aries, Mrs. B. C. Frost, Mr. E. B. Trubshaw, Mr. V. C. Varcoe, Mrs. R. H. Studholme, Col. Alderman and Sheriff R. H. Studholme, The Lady Mayoress, Lady Waley-Cohen, Mrs. J. T. Percy, Rev. Canon Leslie Wright, The Lord Mayor, Sir Bernard Waley-Cohen, Capt. J. T. Percy, Sir Frederick Tymms, Dr. K. G. Bergin, Master, Mrs. K. G. Bergin, Lady Tymms, Mrs. A. K. Kirk (Mrs. A. M. A. Majendie is just behind Mrs. Kirk). Below : Mrs. M. J. Lithgow, who received the Derry and Richards Memorial Medal on behalf of her husband, being received by Dr. and Mrs. Bergin.

Photographs copyright "The Aeroplane and Astronautics"

have detracted from this success, since the accident was found to have been due to an error of judgment on the part of the test pilot and not to any fault in the aircraft. Photographs seen by our correspondent at Leipzig of the aircraft works at Dresden show that, in fact, this machine was already in series production there. It was to be followed up close by an improved type, the 155, details of which, however, were not available.

Meantime the U.S.S.R. had produced an aircraft, the Il-18, with characteristics making it suitable for much the same service as the 152 or 155. The Dresden aircraft factory was employing part of its capacity on the production of the earlier and smaller Il-14, under Soviet licence. Such an arrangement was clearly uneconomic, and otherwise undesirable within a system of international rationalization as is Mutual Economic Aid. It is therefore not surprising that the decision has now been taken to close down the East German aircraft industry.

The factory for development and production of jet units at Pirna, however, is to survive, it would seem, but will concentrate on the production of small units, such as the Pirna O 17 E (maximum output, 130 h.p.: working output, 110 h.p.), which can be used to drive electric generators or, possibly, for road or rail propulsion (a very neat little generating set, the Turbolekt 9526, produced by VEB Entwicklungsbau, Pirna, in conjunction with Fimag, Finsterwalde, was exhibited, and worked periodically, at the Leipzig Spring Fair).

Last Link Severed

AFTER devoting many years to furthering British aeronautical exports and having played a leading part in de Havilland affairs since the very early days, Mr. F. E. N. St. Barbe, the remaining active founder of The de Havilland Aircraft Co., Ltd., retired from the board of the company on Mar. 31.

He was the youngest of the five men who formed the company in 1920 and who directed its activities right through to the post-war years. Sir Geoffrey de Havilland, Mr. F. T. Hearle, Mr. C. C. Walker and Mr. W. E. Nixon have all relinquished their directorships in recent years, Sir Geoffrey continuing as president.

Mr. F. E. N. St. Barbe.

Mr. St. Barbe, who had been a member of the Airco team during and even before the 1914-18 War, went with "D.H." to the new company at Stag Lane as business manager. He conducted the sales of de Havilland products for more than a quarter century, and built up the world-wide marketing organization which now serves Hawker Siddeley Aviation.

He arranged the formation of the Australian company in 1927, the Canadian company in 1928, the Indian branch in 1929, the South African company in 1930, the New Zealand company in 1939 and the American company in 1953. He was a director of nearly all the home and overseas companies for long periods, and was deputy chairman of de Havilland Holdings, Ltd., the parent company formed at the end of 1955. He has served on the council and the management committee of the Society of British Aircraft Constructors, and was chairman of the sales and export committee for many years since the War.

A Missiles Dinner at Cranfield

MANY well-known people in the missile field went to the dinner held on Mar. 24 at the College of Aeronautics to meet members of its fifth course on guided missiles. Members of these courses, each of which lasts a year, are all drawn from overseas countries. The current course at Cranfield has 19 members.

Countries represented, and the number of students from each, are: the Argentine (two), Belgium (one), West Germany (nine), Holland (one), India (three), Norway (two) and Yugoslavia (one). More than half the students are officers from the Services of their countries. At the dinner the 19 current students were outnumbered by 26 "old boys" who had made special trips to attend the dinner and a two-day missile symposium held at the College.

This can certainly be taken as a fine tribute to the international value of this particular course at the College of Aeronautics and is also an interesting indication of the close attention that is being paid, by the military services in Europe, to developments in missile technology.

The toast to the guests was proposed in a highly appreciated fashion by PROF. J. A. J. BENNETT, who referred, among many other things, to the missile developed by a country not represented on the course. It was called the Civil Servant because it would not work and could not be fired. SIR JOHN CARROLL replied on behalf of the guests.

The toast to the College of Aeronautics was proposed by MR. P. RULLA, a German member of the course. His humorous speech made many references to the reactions of foreign students both to Britain and to the College. In his reply MR. H. C. WILTSHIRE spoke of the good effect of the course on international understanding; he hoped that in future the countries represented would send students to the College course on space technology.

Aviation News in General

TEST BED.—Flight tests of the Canadian Pratt & Whitney PT6 turboprop are to be made with an engine installed in this Beech 18. PT6 progress is described on p. 419.

NATO AIR DEFENCE.—The assignment of Fighter Command to the unified NATO air defence system is to take effect from May 1. Forces assigned to SACEUR will include Fighter Command air defence squadrons, operational units of the Bloodhound Mk. I SAGW system and the U.K. control and reporting system.

SKYBOLT PROGRESS.—According to Mr. John Gorgenson, Douglas programme manager for the ALBM: "Adaptation of the Vulcan required to accommodate the Skybolt will provide no major problems. The programme is progressing most satisfactorily." He was speaking at a week-long conference held in Culver City, Calif. This was attended by an eight-man Avro team headed by Mr. T. A. House, project designer, Mr. J. W. McIvor and Mr. E. Campbell of the M.o.A., and representatives of the U.S.A.F. and Douglas Aircraft.

APACHE DELIVERY.—Six Piper Apaches are due to arrive by air at Speke Airport, Liverpool, on Sunday, Apr. 23, after a mass transatlantic delivery flight. They will be led by record-breaking ferry pilot Max Conrad, and escorted into Liverpool on the last leg of the flight by U.K. Piper sales agent Wg. Cdr. Tim Vigors. The Apaches have been bought by the National Air Training School at Hamble, for airline pilot training.

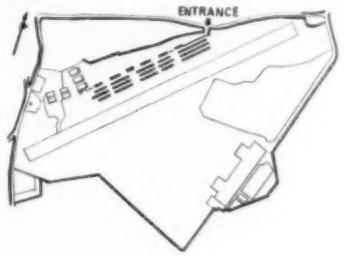
LONDON-PARIS ANNIVERSARY.—The day on which a man was first put into orbit was also the 50th anniversary of the first direct London-Paris flight. This was by M. Pierre Prier in a Gnome-Blériot from Hendon to Issy-les-Moulineaux in a time of just under four hours on Apr. 12, 1911.

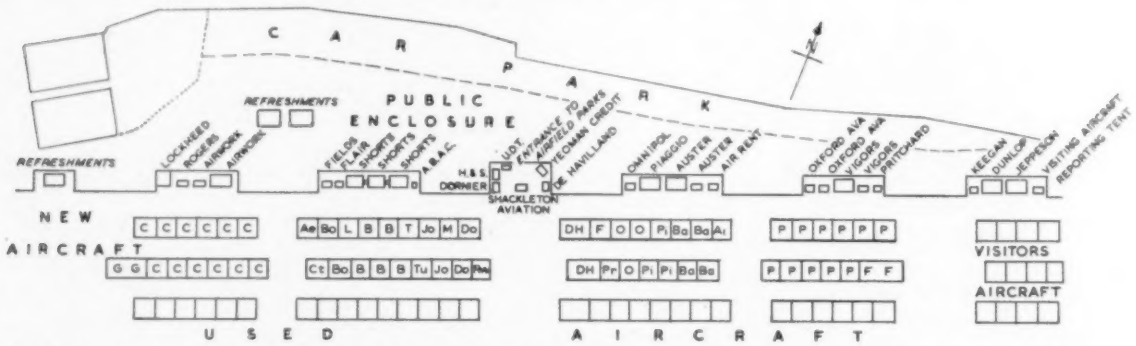
AFRICAN ALOUETTES.—An undisclosed number of Alouette III helicopters has been ordered from Sud-Aviation by the Union of South Africa.

CUBAN STRIKES.—Defecting elements from the Cuban Air Force last week bombed and strafed several air bases in Cuba in Douglas B-26B Invaders, one of which subsequently landed on one engine at Miami, Fla. The remainder are reported to have flown to Guatemala or neighbouring Caribbean islands where anti-Castro forces have been established.

SKYCRANE NEWS.—First flight of the twin P. & W. JFTD-12 turbine-powered Sikorsky S-64, a development of the S-60 Skycrane, is scheduled for the end of the year. In addition to the prototype two will be built for West Germany. The German Services are at present evaluating a complete mock-up. This is to be shown at the Paris Salon. Designed payload capacity of the S-64 is about 17,600 lb. The S-60, a piston-engined predecessor of the S-64, crashed and was destroyed early in April after being fitted with high-sensitivity controls for NASA investigations.

MET. ROCKET.—A 6-ft. solid-propelled weather research rocket is being developed for the Meteorological Office by Bristol Aerojet. It will carry 10 lb. of air-temperature and pressure-measuring instruments to a height of 40 miles. Tests begin next year, probably at South Uist in the Hebrides or Aberporth, South Wales.




C A R P A R K
REFRESHMENTS
PUBLIC ENCLOSURE
REFRESHMENTS
LOCKHEED ROGERS AIRWORK AIRWORK
FIELDS FLAIR SHORTS SHORTS SHORTS A.R.A.E.
H&S DORNIER
U.D.T. ENTRANCE TO AIRFIELD PARKS YEOMAN CREDIT DE HAVILLAND
SHACKLETON AVIATION
OMNIPOL PIAGGIO AUSTER AUSTER AIR RENT
OXFORD AVA OXFORD AVA VIGORS VIGORS PRITCHARD
KEEGAN DUNLOP JEPPESON
VISITING AIRCRAFT REPORTING TENT
NEW AIRCRAFT
C C C C C C
Ae Bo L B B T Jo M Do
DH F O O Pi Ba Bo Ai
P P P P P P
G G C C C C C C
Ct Bo B B B Tu Jo Do Rw
DH Pr O Pi Pi Ba Bo
P P P P F F
VISITORS AIRCRAFT
U S E D
A I R C R A F T

SHACKLETON WEEKEND.—This plan shows the proposed layout of displays at Baginton Aerodrome, Coventry, on Apr. 28-30. New aircraft exhibits are: Ae, Aero Commander; Ai, Aircoupe; B, Beechcraft; Ba, Beagle Auster; Bo, Bölkow; C, Cessna; Ct, Champion Tri-Traveler; DH, de Havilland; Do, Dornier; F, Falco; FF, Fokker Friendship; Jo, Jodel; L, Lockheed LASA; M, Miles Student; O, Omnipol; P, Piper; Pi, Piaggio, Pr, Prospector; Rw, Rhein-Flugzeugbau; T, Tipsy Nipper; Tu, Turbulent.

Commercial Aviation Affairs

ATLANTIC FREIGHT MEETING.—The renewed IATA conference on North Atlantic cargo rates will begin in Montreal on May 1. Mr. H. B. Renwick, vice-president of Canadian Pacific Airlines, will be chairman. Existing rate agreements will, as already stated, continue until Jne. 30.

MORE 720s.—Pacific Northern Airlines, of Seattle, which operates within Alaska and over the Seattle-Alaska route, has ordered two Boeing 720s for delivery next spring. Braniff Airways has ordered a fourth Boeing 720-027. The total of Boeing jet transport sales is now 367.

HELICOPTER UTILIZATION.—In less than three years the five Boeing Vertol 44 helicopters in New York Airways' fleet have each flown more than 4,000 hr.—or a total of more than 22,000 hr. between them. N.Y.A. is due to put twin-turbine Vertol 107s into operation later this year.

FEBRUARY TRAFFIC.—Provisional estimates for U.K. airlines' scheduled and inclusive-tour traffic in February show an increase of 16.7%—to 32 million short ton-miles—in relation to the February, 1960, figures. The overall load factor fell from 57% to 52%.

PRESTWICK-GATWICK.—Overseas Aviation (C.I.) will start its thrice-weekly return service between Gatwick and Prestwick in June, using 48-seat Ambassadors.

EAST AFRICAN V.G.P.I.s.—Visual glide-path indicators are to be installed at Entebbe Airport, Uganda, and Nairobi Airport, Kenya. This was agreed at last month's meeting of the Southern Africa Committee on Air Navigation and Ground Organization.

PRESTWICK'S TERMINAL.—Work on the new terminal building at Prestwick Airport is to start in June and the building is due to be completed for the 1963 summer season. The layout will be of the single-finger type, with eight aircraft-stand positions.

CARIBBEAN A.T.C.O.s.—The 1959 contract, whereby International Aeradio has been supplying six air traffic control officers for Jamaica's Palisados and Montego Bay airports, has been renewed for a further two years and has been extended to cover three additional A.T.C.O.s.

TEAL ATTACHMENT.—The last of eight R.N.Z.A.F. aircrew, who have been flying as co-pilots and flight engineers with TEAL in DC-6s since December, completed his final operation on Mar. 16. They were brought in to help while the Electras were grounded for modification.

PROSECUTIONS PENDING.—Canada may soon prosecute those international airlines, including T.W.A. and P.A.A., which are refusing to pay the $64 per flight charge for using Canadian airspace. An additional charge of $20 is made if the aircraft makes radio contact with the ground.

MANCHESTER AGAIN.—On May 1 B.O.A.C. will resume Boeing 707 services through Ringway Airport, Manchester, following the completion of runway-improvement work there.

L-1049s TO PARIS.—Air France is to use L-1049G Super Constellations for the two evening services which are to be operated to and from Gatwick during this summer.

CLEARING HOUSE.—International airline business settled through the IATA Clearing House in London during 1960 totalled £547,273,000—an increase (after adjustment for rearrangement of procedures by two members) of 32.6% on the figure for 1959. Cash payments were eliminated in 89.8% of the turnover.

ARCTIC J.A.L. — Inauguration of Japan Air Lines' polar services will be Jne. 6, not Jne. 1 as previously announced. Twice-weekly flights will be operated between Tokyo and London/Paris via Anchorage (Alaska) and Copenhagen, with DC-8Cs.

LONDON OFFICE.—Cathay Pacific Airways, of Hong Kong, now has a sales office in London—at Dunster House, 17-19 Mark Lane, E.C.3. (Mincing Lane 2252.)

A.I.I. STEP-UP.—From May 1 Air India's four Boeing 707-437s will be operating six services a week between Bombay and London—five of which will continue across the North Atlantic to New York. One of these flights will offer a new service between Prague and New York, via London.

THREEPENCE A MILE.—Thirty of the 62 weekly turbojet flights scheduled by Pan American between New York and Puerto Rico will be "thrift fare." On these services the single fare for the 1,612-mile journey will be £19 13s.—or a little less than 3d. per mile per passenger.

CARAVELLES TO MOSCOW.—Caravelles will be put into the Paris-Moscow route by Air France on May 15, with a flight time of four hours. The Air France summer schedules include 66 flights a week between London and Paris and 19 a week between London and Nice.

SOUTH AMERICAN CRASHES.—A Linea Aeropostal Venezolana DC-3 disappeared on Mar. 10 with eight passengers and crew of four. It has now been reported that it crashed into Mt. Turmal. The wreckage of the Chilean DC-3, which has been missing since Apr. 3 (see last week's issue, p. 390) was found on Apr. 10 at about 10,000 ft. in the Andes and 205 miles south of Valparaiso. No survivors were reported.

News About People

IATA TRAFFIC DIRECTOR.—Mr. H. Don Reynolds, previously assistant vice-president and former general traffic manager of American Airlines, has been appointed traffic director of IATA in succession to Mr. John W. S. Brancker who left the Association last summer. Mr. Reynolds' experience includes 19 years in aviation on legal, management and traffic work in the U.S.A. and elsewhere. He was born in 1911 and graduated from Northwestern University law school in 1936. He was admitted to the New York Bar in 1951 and is a former airline attorney and chief of enforcement and litigation of the U.S. Civil Aeronautics Board.

Mr. H. Don Reynolds.

ALCAN APPOINTMENTS.—Newly elected directors of Alcan Industries, Ltd., are Mr. A. A. Bruneau and Mr. R. J. Moyse.

PLESSEY INSPECTOR.—The Plessey Group has appointed Mr. L. Walker as chief inspector. He previously held a similar position with Scottish Aviation.

WOODFORD VISIT.—Mr. T. N. Kaul, Deputy Indian High Commissioner, paid a visit to A. V. Roe's Woodford factory on Apr. 11 where he inspected the 748 production line and prototype aircraft. He was met and escorted during his visit by Sir Roy Dobson and Sir Harry Broadhurst.

OXFORD OPERATIONS.—Mr. J. W. Pooley, formerly with Metropolitan Air Movements, Ltd., has joined the Oxford Aviation Co., Ltd., of Kidlington, as operations manager. He has had considerable experience of helicopter operations.

GENERAL MANAGER.—Mr. H. P. Snelling, previously Skyways' general manager (commercial), is, on May 1, taking up the post of general manager, Bermuda and Nassau, with Cunard Eagle Airways (Bermuda). Mr. Snelling has been with Skyways since 1952 and was general manager of the original Skyways operating from Dunsfold.

AER LINGUS MANAGER.—Mr. Geoffrey Pitt has been appointed general manager, Britain, for Aer Lingus. Mr. Pitt has been associated with Eagle Aviation/Airways for 14 years, became a director in 1956 and was appointed sales director of Cunard Eagle Airways in May last year. He started his 17-year aviation career with B.O.A.C. in 1944.

Mr. Geoffrey Pitt.

ELECTRONICS LIAISON.—Mr. G. Barnes has joined Ultra Electronics, Ltd., as the company's liaison officer with Miles Electronics, Ltd. Ultra recently acquired a third share in the Miles concern.

OPERATIONS MANAGER. — Mr. D. Willis, previously assistant to the operations director, has been appointed operations manager for Overseas Aviation (C.I.) in succession to Mr. G. P. L. Dunstone.

Air Cdre. Watson whose appointment as Rolls-Royce London representative is recorded on page 419.

RECOGNITION MEETING. — Mr. Peter Masefield will deliver the annual presidential address to the Aircraft Recognition Society at the meeting to be held at 19.00 hrs. on Apr. 25 in the R.Ae.S. lecture theatre, 4 Hamilton Place, W.1. His subject will be "A Review of World Civil Aviation 1960 and a Forecast for the Future." Readers of THE AEROPLANE AND ASTRONAUTICS will be made most welcome.

THUNDERBIRDS LOSS. — Maj. Robert Fitzgerald, leader of the U.S.A.F. Thunderbirds F-100 aerobatic team, and Capt. George Nail, the team compere, were killed in a crash on Apr. 6. It is reported that they were not practising aerobatics at the time.

Air Transport

Profitless Venture?

ONE manufacturer, at least, in the U.S. is taking a gloomy view of the prospects for supersonic airliners after examining the problems involved more closely. This is the impression one gains on reading an analysis of the market for supersonic transports which has been prepared by the Convair commercial sales department.*

This report concludes that the airlines should be able to use 150 Mach-3 airliners of steel and titanium construction in 1970-75. They should be suitable for coach-class operation and are expected to account for slightly above 60% of the Free World traffic over ranges greater than 1,000 miles. The optimum aircraft is expected to carry 130 passengers and have a range of 4,000 miles. It is considered unwise to build a Mach-2 aluminium-alloy airliner which might well be obsolete before it entered service. Aluminium-alloy construction would prevent "stretching" the airframe for operation at higher speeds.

If all the aircraft are made by a single manufacturer they should cost about $14.1 million. But if two competitive types are produced the unit cost would rise to $17.4 million, and with three manufacturers to $20.1 million. Operating economics would be unacceptable if the unit cost rose to about $23 million. But the difficulty of estimating costs is shown by the 25% difference between the first-cost estimates independently calculated by the Convair divisions at Fort Worth and San Diego.

Convair conclude that it is technically possible to build a supersonic transport and that each of five U.S. manufacturers should be able to do so. But, if the project is to make economic sense, the aircraft should be built by a single manufacturer and no one company could afford to finance it. This is because the development costs will be high, the production rate low and the overall time of the programme very long. It would require an initial investment of at least $200 million in the early 1960s and this money might well be tied up until 1980.

The test programme from prototype to certification is expected to take four years. About $500 million or more will have to be set aside for seven to 10 years before there is any return at all. Not only is the risk great and the return small, but any difficulties with the aircraft itself could wipe out a potential profit completely.

A reasonable interest on the investment could not be realized and borrowed capital would be excluded; the programme is just not suitable for private investment. But if U.S. Government funds were made available, the investment could be returned—but it would have to take the form of an interest-free loan.

From a manufacturer's viewpoint, the programme will be marginal even if all goes well. But Convair consider that it is questionable whether all the operational problems can be forecast and solved without adequate supersonic experience.

Cost could be increased very greatly if changes were imposed in standards, requirements or regulations after the programme had reached an advanced stage. If extensive changes proved necessary, as a result of F.A.A. evaluation, supersonic-boom experience, legislative restrictions, or pilot pressure, the development costs of the aircraft could be more than doubled.

For these reasons Convair suggest that further flight experience must be gained before the design of a supersonic transport is finalized. This could be done with an aircraft derived from the B-58 Hustler bomber and powered by J58 engines. It would cruise at speeds up to Mach 2.4. Twelve of these aircraft could provide 10,000 hours of flight experience at speeds above Mach 1.5 by mid-1967, at a cost of $237 million.

A programme of this type would provide supersonic-boom and piloting experience and give the F.A.A. and legislative groups the necessary background to establish aircraft requirements. It would greatly reduce the risks in the development of a supersonic airliner.

* "Report SE 476: Supersonic Transport Market Analysis," by Sales Engineering, Commercial Sales Department, Convair, San Diego.

Weather or No

THE ancient argument, about whether the aircraft captain should have the final say in the question of the suitability of conditions for take-off, has cropped up again in the U.S.A.

Early last month the Federal Aviation Agency reported in a news release that it had instructed air traffic controllers to refuse clearance to commercial flights, passenger or cargo, when airport visibility is less than a quarter of a mile or when the measured runway visual range is less than 2,000 ft. Aircraft on executive, ferrying, or training duties are, so long as they are not carrying passengers or cargo for hire, exempt from this ruling.

This is the first time that the A.T.C. clearance authority has been extended beyond that concerned with actual traffic conditions, and the order is especially interesting because the former F.A.A. administrator, Mr. E. R. Quesada, expressed diametrically opposite ideas in an article which was quoted by Flight Safety Foundation in a recent *Accident Prevention Bulletin* (61-3, Mar. 27).

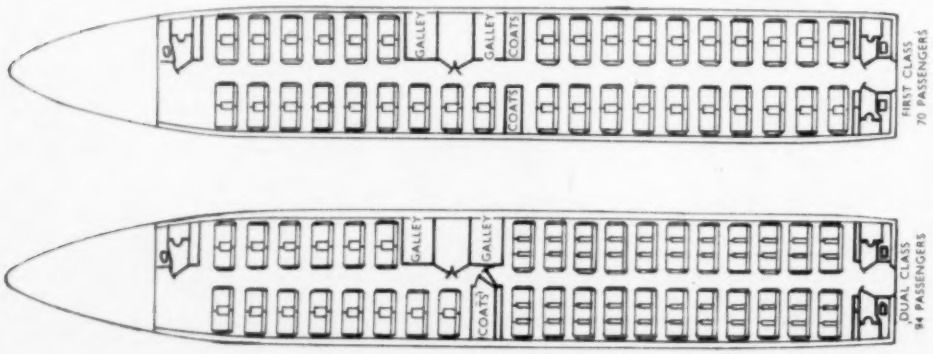
"Suggestions have been made," wrote Mr. Quesada in the Feb. 12 issue of *The New York Times Magazine*, "that a Federal official should have absolute control of the right to take off in heavy weather. The argument runs that airlines exert a certain amount of pressure on their captains to fly even under hazardous conditions and that governmental control would protect the public.

"Such action would be wrong.

"No official at an airport can assume the burden of knowing all the infinite details that each of many pilots operating out of the airport must know. Each pilot has absorbed the characteristics of his aircraft, its loading and its flight plan. He alone knows if it is wise for him to fly. . . .

". . . the Federal Government should continue to establish standards of visibility and ceiling below which no flight should be attempted, and then step aside. In all other cases the final decision, on each of the variety of situations presented, must be a matter, as it is now, between the airline and its captain."

As the *Bulletin* remarks, it is "entirely possible" that in this instance we shall find that airline pilots are on the side of the former administrator—who was sometimes so vigorously resisted by them when he was himself in office.



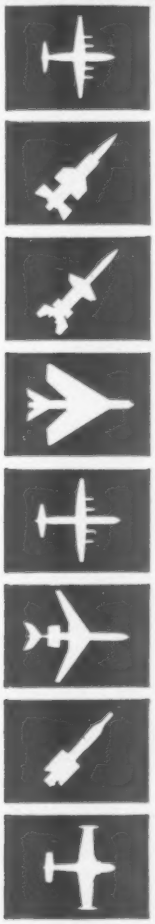
727 LAYOUTS. — Two passenger arrangements for the Boeing 727 (see following page). Above is a layout for 70 first-class, four-abreast seats at 38 in. pitch; below is a mixed-class layout for 28 first-class passengers and 66 six-abreast tourist seats at 36 in. pitch.

BRITISH AIRCRAFT CORPORATION

Incorporating the Aircraft and Guided Weapons interests of —

BRISTOL AIRCRAFT LIMITED
ENGLISH ELECTRIC AVIATION LIMITED
VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED
HUNTING AIRCRAFT LIMITED

The new force in world aviation



VISCOUNT
VANGUARD
VC 10
BAC 107
SUPERSONIC AIRLINER PROJECT
T-188
CANBERRA
LIGHTNING
TSR-2
JET PROVOST
BLOODHOUND
THUNDERBIRD
VIGILANT
BLUE WATER

BRITISH AIRCRAFT CORPORATION

ONE HUNDRED PALL MALL LONDON SW1

TGA BAC1F

For defence tomorrow's threats

Bloodhound Mark I is the defence-system chosen by the
Air Forces of Great Britain, Sweden and Australia.
Now under development is Bloodhound Mark II—the guided missile
system which is ahead of tomorrow's problems of air defence

BRISTOL/FERRANTI

BLOODHOUND

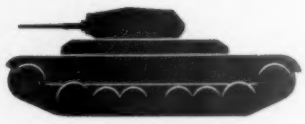
BRISTOL AIRCRAFT LTD., FILTON HOUSE, BRISTOL. A Company of

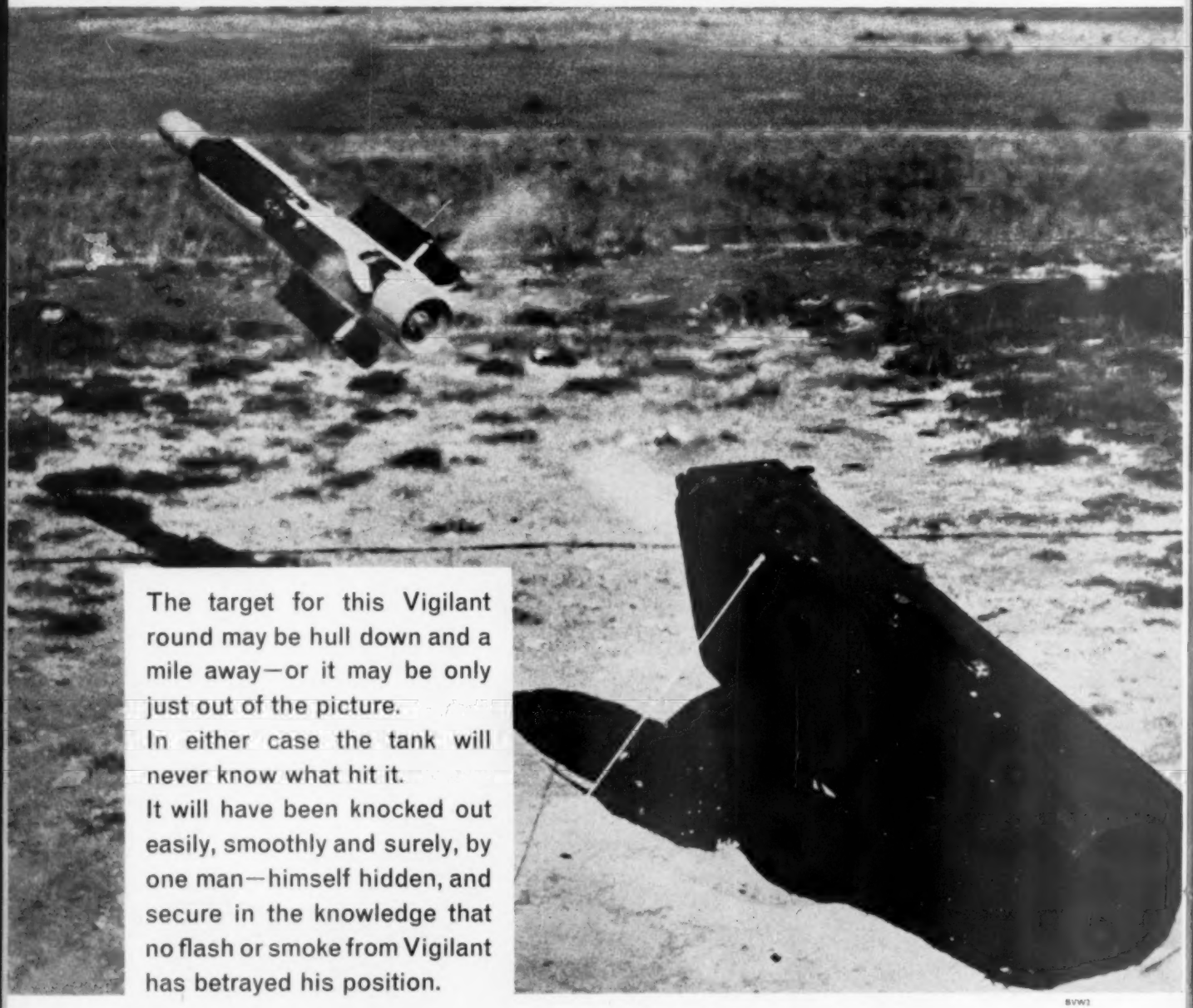
BRITISH AIRCRAFT CORPORATION

ONE HUNDRED PALL MALL LONDON SW1

against

THE BEGINNING OF THE END OF A TANK





The target for this Vigilant round may be hull down and a mile away—or it may be only just out of the picture.
In either case the tank will never know what hit it.
It will have been knocked out easily, smoothly and surely, by one man—himself hidden, and secure in the knowledge that no flash or smoke from Vigilant has betrayed his position.

BVW1

VICKERS **VIGILANT**

one-man anti-tank weapon

VICKERS-ARMSTRONGS (AIRCRAFT) LTD. WEYBRIDGE SURREY A Company of

BRITISH AIRCRAFT CORPORATION

ONE HUNDRED PALL MALL LONDON SW1

Air Transport . . . .

The Air Freight Business

THE 1960 import-export figures for the U.K. show, once again, a steadily increasing use of air freight—though the percentages of the totals are necessarily meagre except in the cases of specific commodities which are of relatively high intrinsic value.

These Board of Trade figures deal in total sterling values and not in weights, so only the percentages relationships between air and surface movements for different types of commodity provide a real guide to the situation. Nevertheless, total air-freighted import values rose by 28% by comparison with the figures for 1959, exports rose by 24% and re-exports by 18%.

The value of air-freighted imports amounted to 3.9% of the total imports; for exports the ratio was 5%; and for re-exports it was 20.5% of the total movements.

Of the different commodities freighted by air the biggest values (34% and 22% of the total air freight respectively for exports and imports) were for those represented by "machinery other than electric." The highest ratios of air-freight values in relation to surface freight values of the same commodities were, in the case of exports, for "silver, platinum and jewellery," at 57% of the total. Among imports the most-air-freighted commodities were, at 40% of the total value, "scientific instruments, photographic and optical goods, watches and clocks," with "electric machinery, apparatus and appliances" as runners-up at 36%. Interestingly enough, among the re-exports, the value of the air-freighted "scientific instruments, etc.," was 66% of the total.

All of which makes, in its way, rather sadly significant reading. Air-freight rates are such that only goods of very high value in relation to their weight and volume are being flown in any appreciable quantity in relation to those carried by surface means. Even "road vehicles and parts and aircraft parts" were exported by air only to the extent of 3% of the total value (£468 million)—though 20% of a very much smaller total value (£45 million) was imported by air.

The Vanguard and Reduced Fares

TRANS-CANADA AIR LINES will lower passenger fares from Canada to Nassau (Bahamas) and the West Indies by as much as 35% on May 15, when it introduces 17-day excursion rates and reduced regular fares. The new rates follow the introduction of the Vickers Vanguard on the West Indies services on Apr. 1. They are particularly significant in view of T.C.A.'s recently announced 1960 deficit of $2,607,350, the first in 10 years.

This deficit (see our issue of Mar. 23, p. 314) was due principally to a reduction in average return per seat-mile flown and to increased expenses largely associated with the introduction of the DC-8 and Vanguard. It might be reasonably assumed that such a loss would make T.C.A. reconsider its new policy (see our issue of Nov. 18, 1960, p. 681) of reducing fares and passing the economies of long-haul transportation on to the public.

However, such is the company's faith in this policy and in the economies of an all-turbine fleet that the lowered fares were introduced. The Vanguard is expected to make an important contribution, as it is ideally suited to the directional and cyclical nature of traffic on many T.C.A. services. On short runs like Montreal-Toronto, its chock-to-chock time is competitive with that of the jets, while on the West Indies run it can use fields too small for even the medium-range jets.

T.C.A. attempted, at the Bermuda IATA Traffic Conference, to have the reduced fares applied generally, but other carriers, especially American ones, decided that the fares would apply only to persons residing in Canada or to Canadians living outside their country. The lower Canada-Bermuda fares apply to all persons.

Under the new rates, the Toronto-Nassau return fare of $110 will be $33 less than the New York-Nassau return excursion, although the distance of the latter is about 300 miles shorter.—N.A.M.

More 727 Details

BOEING has recently issued one of those large and splendid general information brochures on its short-haul 727 turbojet. This does not give very much technical detail—or more dimensional, weight and performance information than which was obtained for, and used in, the tabulations (pp. 401-406) prepared for last week's Commercial Aircraft Number—but it includes some approximate cost and other curves and a schematic cutaway of the JT8D-1 turbofan.

This drawing shows the JT8D-1 engine to be of a conventional two-spool front-fan type with clam-shell type reversers (for which better than 50% of normal maximum thrust is promised) and with a noise-abating and mixing device at the annulus where the high- and low-speed flows merge. Features mentioned in the brochure text include "tuned" inlet panels to reduce compressor noise and a one-piece case to eliminate performance "leaks." A spot specific fuel consumption of 0.812 lb./hr./lb. thrust is given for M=0.82 at 35,000 ft.

The simple direct-cost curve in the brochure shows a minimum of about $1.23/stat. mile at a range of 1,400 stat. miles and of $1.4 at 600 stat. miles.

The 727's 3,000-p.s.i. hydraulics are broken down into two basic systems (A and B). One is supplied directly by two engine-driven pumps and the other by two electrically actuated pumps. There are hydraulic pumps on the two side engines and A.C. generators on all three.

The primary flight controls include an integrated aileron-spoiler system for lateral control, with the inboard ailerons used at high speed and the outboard ailerons at low speeds. Their operation is hydraulic, with a continually operating mechanical system as back-up. The two rudder sections, each capable of providing adequate control, are powered from separate hydraulic sources. The elevators are operated by dual hydraulic power units, supplied from separate systems, with automatic manual reversion.

Of the secondary flight controls the triple-slotted flaps are hydraulically operated, with stand-by electric actuation. The leading-edge devices consist of retractable slats outboard and Kreuger flaps inboard.

Cargo/Passenger DC-8

THE Douglas Aircraft Co. is to go ahead with a private-venture cargo/passenger variant of the DC-8 which will be available for delivery late next year after a first flight in August, 1962. Named the Jet Trader, this DC-8F is expected to be offered for $6,500,000 (£2,320,000), or about $500,000 more than the present cost of the passenger version of the turbofan Series 50.

It will not be a thorough-going freighter modification of the standard aircraft, and only the forward section of the main fuselage and the rear underfloor areas will be redesigned for cargo carrying. The rear section of the fuselage will be normally furnished for 54 passengers. The space-limited

maximum payload, assuming cargo at 10 lb./cu. ft. density and a full passenger cabin, will be 62,610 lb., of which some 52,000 lb. will be cargo.

Access to the cargo section will be through an 86 in. x 140 in. forward door and provision will be made for mechanized loading with nine 81 in. x 110 in. pallets, which will be moved on rollers and guide rails and locked into place on floor tracks.

The DC-8F will be powered by four P. & W. JT3D-3 turbofans of 18,000 lb. static thrust each. The design gross (ramp) weight will be 312,000 lb. and the maximum take-off weight will be 310,000 lb., for which an F.A.A. take-off field length of 8,850 ft. is estimated. The maximum range—still air, zero payload, capacity fuel (156,760 lb.)—will be 6,160 naut. miles; this should be adequate for full-payload, non-stop North Atlantic operations in all conditions.

The proposal has been discussed by Douglas with "several airlines" and their reactions have been sufficiently favourable for the go-ahead.

Air Transport . . . .

Rationalizing the Cargo-rate System

JOHN W. S. BRANCKER, *IATA's Traffic Director*, 1953-60,
discusses the conflicts between weight-breakpoint and commodity-rate systems and offers a series of pointers towards the application of a satisfactory and stable rate structure.

IT now seems that the North Atlantic carriers have had further thoughts about the possible delights of open cargo rates and have agreed, albeit somewhat reluctantly, to meet again to try to settle their differences. This action may well have been influenced by Government pressure to avoid a rate war at a time when airline finances are not particularly buoyant.

In the meantime, the "open" situation, which would have come into existence on Apr. 10, has been averted by a mail vote agreement to continue charging the existing tariffs until Jne. 30.

Any agreement reached at the next meeting—if, in fact, there is agreement—must in practice be considerably influenced by the action which the airlines have already taken during their short spell of theoretical freedom.

Since the failure of the meeting in Paris each individual carrier has gone ahead and published the rating system which seemed best to him. In some cases two or more airlines have filed similar rates but, generally speaking, each has gone his own way and has tried to emphasize in his publicity that he is the carrier offering the most attractive reductions.

Detailed comparisons would be difficult and complex but, broadly speaking, the differences still indicate the divergence of view between the commodity-rate school and the breakpoint school. This particular problem will be dealt with more fully later in the article, but the important point is that reductions of one kind or another have been offered to the public and, in spite of being hastily, and one hopes temporarily, withdrawn, it will be virtually impossible for the airlines to reach any permanent agreement which does not continue to offer serious reductions.

Rate Stability

So far so good, but the method of procedure is, of course, lamentable, and tends to indicate one of the major misconceptions about cargo rates; if they are to attract traffic—and that is, after all, an important object of the exercise—they must not be altered at short notice. It is true that sudden changes in passenger fares are also to be deplored (they also cause confusion), but the airlines must realize that, in order to sell air cargo effectively, rates must be stable and considerable notice must be given if changes are planned—and particularly so when the change is upward. From the point of view of developing traffic, it is possibly less important that every air carrier should charge the same, than that each carrier should maintain the same rates for a reasonable period—always provided that those rates are set at the right level.

The chief argument which is likely to arise at any future meeting about cargo rates is almost certain to be the time-honoured one which has bedevilled all cargo discussions in the past—and that is the unsolved conflict between commodity rates and breakpoints. While each system has its merits and disadvantages, according to the circumstances in which it is used, it is difficult to find a sensible compromise between the two, although a gallant attempt to do this was made in the tariffs which were filed by B.O.A.C. when they thought that an open-rate situation would prevail. There has, moreover, been very little inclination to compromise in the past, and the commodity-rate system, which has been in force on the North Atlantic for a number of years, has been less successful than it should have been—not so much because the system itself is inherently wrong, but because it has never been applied in the proper way.

In some respects the IATA machinery is not very well adapted to solving this problem because, although it is possible to find a mathematical compromise in reaching agreement on passenger fare levels, this approach cannot be used to establish an intermediate point between two different systems which are, to some extent at least, mutually antagonistic. However, it is certainly not impossible.

A point which does not seem to be wholly realized by the airlines is that the situation underlying the collection and dispatch of cargo is not the same on each side of the Atlantic.

Almost all cargo originating in North America and destined for Europe is funnelled through New York as a gateway. Cargo originating in Europe, however, and bound for North America, goes through no single gateway on the eastern side of the Atlantic, and the situation with regard to consolidation is, therefore, completely different.

In Europe the intermediary between the shipper and the carrier acts almost wholly as an agent; the indirect carrier and consolidator are much rarer birds. They may tend to develop as intra-European trade agreements become stronger, but up to the present geography has not been too favourable to them. Although it may appear to be unorthodox, there is nothing really to prevent different rating systems being adopted to deal respectively with eastbound and westbound traffic.

Any flat-rate system which merely gives reductions in the case of consignments of more than a specified weight—i.e., a breakpoint system—and which takes no account of the actual commodity being carried, appears both crude and limited in comparison with the rating systems which apply in the case of comparable surface transport. It gives considerable power to the large consolidator, where conditions are favourable to consolidation, and may well result in high-value goods paying very much less than the traffic will bear. The carrier, therefore, handles very little high-rated traffic to offset lower rates which could generate considerable volume at the other end of the scale. A breakpoint system has the merit of being extremely simple to apply, but this merit has less value than may appear at first sight because the intelligent cargo agent is skilful at using rating systems and the majority of regular cargo traffic is handled through agents.

Commodity rates, on the other hand, will only work effectively if they are applied with the objective of carrying traffic by air which would otherwise move by surface transport, or of generating wholly new traffic. They serve no transport purpose if they result in reductions being given to goods which automatically find it advantageous to travel by air at general cargo rates; nor do they serve a useful purpose if they are fixed below the level necessary to obtain the maximum quantity of the merchandise available. Similarly, they will not generate traffic if the level is too high to attract anything beyond a small trickle of special shipments.

Statistical Comparisons

Their establishment, therefore, must be done on an intelligent basis, and with considerable knowledge of the total cost of shipment by surface means. To repeat what has been said before, they will not be successful unless they are kept in force for a reasonable period, and unless the trade or producers interested in them are given full information and a proper chance of trying them. Carriers, moreover, must keep proper statistics to show the volume of traffic generated by each particular rate, and must compare the results with the total volume of that commodity which moves by all means of transport over the route concerned.

In order to judge the effectiveness of commodity rates, collective figures, showing the total volume of any particular type of cargo moved by air, are really necessary, but in the past carriers have not only failed to make any close analysis of their own carryings, but have shown a marked dislike of any joint approach to the problem.

It is true that recently most North Atlantic operators have been keeping very much more detailed figures covering their own freight movements, but inter-carrier discussions have been governed more by a competitive instinct than the desire to broaden the market in the true sense of the word.

A special group, set up in IATA by the author some five years ago with the declared intention of examining all possible ways in which cargo traffic could be developed, failed almost entirely to produce constructive suggestions because some of the members refused to disclose either their ideas or their intentions.

Not unnaturally, perhaps, the proposals put forward by members are coloured just as much by a desire to reach an agreement which put the carrier proposing it in a particularly favourable competitive position as by the more publicized

attitude of wishing to serve the public and increase the traffic.

The airlines are also faced with the further problem that consolidators can use charter aircraft to carry freight and, if they can put together sufficient loads, can quote rates for all types of merchandise which are remarkably attractive. Some European governments frown on such activities, but there are a sufficient number of "soft spots" in Europe to make the arrangements relatively easy.

Unlike passengers, cargo shipments are not unduly disturbed by circuitous routeings provided that the overall time of transit is kept within reasonable limits and the IATA carriers themselves, with surplus equipment available, are not exactly averse to earning a low per-mile figure when the opportunity offers. The IATA members could indeed control freight charters by resolution, or could at least put a floor to the rates charged, but in many ways this would be about as effective as slamming a swing door. There are any number of non-IATA carriers who would be delighted to tender for the business and, in the light of reason, it is a type of trade which should be allowed to continue.

What, then, should the scheduled carriers do in these circumstances?

First, they would do well to take careful note of the facts of life. The real basis for any rating system must be the production of an average revenue figure per ton-mile which, allowing for sensible load factors, will make an all-cargo aircraft a paying proposition.

Secondly, they would be wise to consider the application of different systems eastbound and westbound. For cargo sold in North America the system might lean more heavily in favour of breakpoints; in the reverse direction the emphasis might well be on commodity rates.

Thirdly, commodity rates must be intelligently calculated and applied—with the primary purpose of generating traffic and not that of favouring local industries. They must not be rejected simply because some carrier does not like the principle and they must be checked all along the line by collective statistics.

Fourthly, there should be a high-level breakpoint for general cargo in both directions offering a rate of about 20 cents per ton-mile to encourage really large consignments.

Fifthly, high-value goods should pay the appropriate rate—which they can—and should not be given unwarranted reductions.

Sixthly, "parcels" traffic, i.e., small irregular consignments, should pay a relatively high rate and minimum charges should be raised.

Seventhly, there should be a deferred-cargo rate, applicable to certain commodities and to shipments over a certain specified weight which could be treated as fill-up load, and which have a deliberately delayed delivery time of, say, five days. Such cargo should be charged at rates some 15% less than equivalent consignments moving at normal rates. A deferred system would not only compete effectively with the movement of freight by charter, but would also help carriers to flatten-out load peaks and fill otherwise empty space.

Eighthly—and last but not least—any new cargo-rating scheme must contain sufficient inducement in one form or another to make forwarding agents anxious to see cargoes moving by air instead of by sea.

If these various factors can be combined to produce an agreed and stable rate structure a great deal of progress will be made. The airlines must bear in mind, however, that the level of rates is a more important factor than the method of rating used in producing volume. The method must not be chosen simply on a basis of individual airline preference—it must be designed to meet the habits and requirements of the shipper and his agent.

Overcoming VOR Siting Snags

IN the United States VHF Omni-range (VOR) has been in operation for about 10 years on a large-scale, practical basis. During these years this point-source aid, providing pilot course and position information relative to a ground station, has proved its several assets—simplicity of airborne receiver/indicator operation; relatively simple circuitry; and good accuracy.

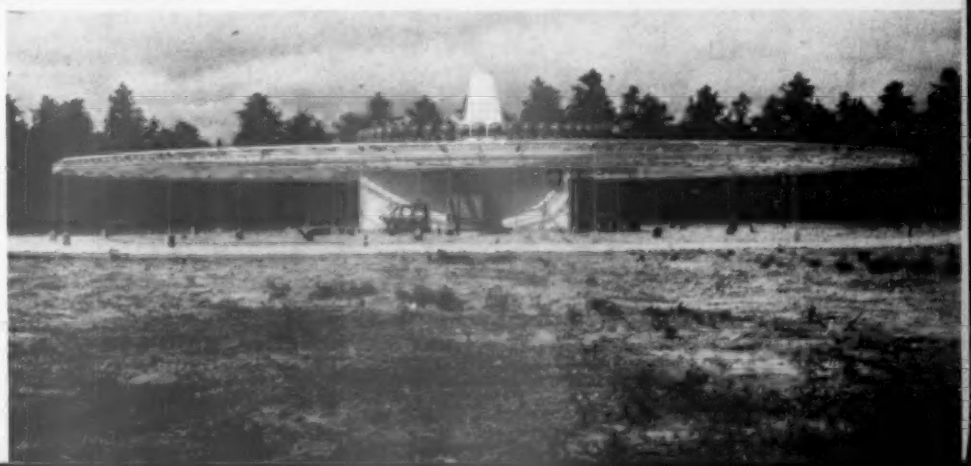
But these advantages of the aid have been offset by some difficult problems concerning the siting of the ground stations. Siting requirements have been somewhat restrictive, leading, in several instances, to some expense in the preparation of a site by way of tree removal, power-line lowering and grading. In a few other instances it has actually been impossible to locate a site because the required preparation was impracticable or impossible.

To overcome these problems the F.A.A. Navigational Aids Engineering Division has been studying Doppler-type VOR, which greatly reduces siting difficulties for the ground equipment. In this form of installation the "Doppler effect" is used to produce the required signal radiation pattern and to correct VOR course information deterioration which results from obstacles, such as trees, around the site. This "moving" radiation is created by the feeding, in turn, of 50 antennae, spaced equally around the periphery of a 22-ft.-radius circle, with one of the beacon's two modulated transmissions. This is achieved with the aid of a distributor rotating at 1,800 r.p.m.

Several existing VOR installations have been evaluated with and without the addition of the Doppler facility. For example, the conventional VOR at Jackson, Mich., was found to have a course deflection of 9° to the right on the 278° azimuth at a radius of 35 miles. With the Doppler VOR this deflection was reduced to 4½°, and is towards the left. Located in a rural area, the Charleston VOR had a 2.8° deflection on a course of 340° at a radius of 20 miles. A Doppler VOR installation reduced this error to 0.4°.

Course and position information radiated by Doppler VOR stations can be used by standard airborne omni-range receivers without modification. The working range of such a VOR station is about 130 miles at 12,000 ft.

Above, a standard U.S. VORTAC installation. Similar to a VOR station, VORTAC is a compromise system having a co-located VOR and TACAN beacon to provide both bearing and distance information.

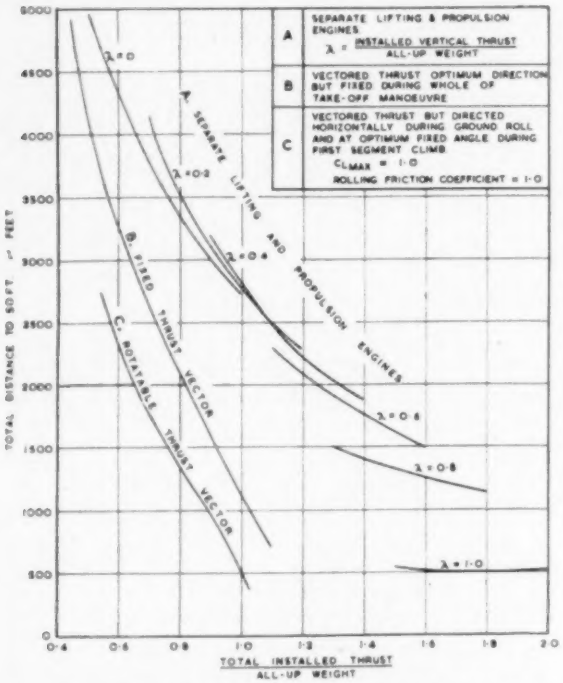


Right, a typical Doppler-type VOR ground station. The 50 Doppler antennae can be seen spaced equally around the main beacon at a radius of 22 ft.

VTO Powerplant Problems

TRENDS in the development of Bristol Siddeley turbofans for supersonic VTOL aircraft were described by Mr. P. J. H. Young, of Bristol Siddeley Engines, Ltd., in a paper read before the Society of Automotive Engineers in New York on Apr. 6. In his paper Mr. Young described Bristol Siddeley views on VTOL powerplants and the development problems which had been met and overcome in producing the BS.53 lift-thrust turbofan which powers the Hawker P.1127 strike aircraft with vertical take-off and landing capability. He went on to discuss future trends of the BS.53 and the development of similar lift-thrust turbofans for supersonic VTOL aircraft. The following account is based on his paper.

Development of the turbofan lift-thrust engine was based on the desire to produce a powerplant which would make possible a "flat-rising" single-engined fighting aircraft. Bristol Siddeley originally had in mind a low-level subsonic strike aircraft in



TAKE-OFF TECHNIQUES.—Take-off distance to 50 ft. plotted against the ratio of total installed thrust to all-up weight for aircraft with separate lift and propulsion engines (A) and lift-thrust engines (B and C).

the 10,000-15,000-lb. all-up-weight class. The aim was to devise a single powerplant which would be fully effective not only during jet-supported vertical flight, but also during conventional wing-supported take-offs and landings, and which would also allow any manœuvres between these two extreme cases.

Possible solutions to the take-off problem are shown in an accompanying diagram. The family of curves labelled A gives the performance that can be achieved with separate lifting and propulsion engines. It is clear that a large saving in total installed thrust can be obtained by compounding the two thrust components and directing the resultant in the optimum direction. This rather obvious gain is demonstrated by the curve labelled B.

There is a further gain if the thrust vector can be rotated continuously throughout a take-off. Curve C was calculated on the simple assumption that the thrust vector acts horizontally during ground run, but is rotated at the instant of take-off to point in the optimum direction, which is held fixed until the 50-ft. obstacle is cleared.

This figure indicates the value, not only of rotating the thrust vector, but also of turning it rapidly to use different directions for the two phases of take-off. On the Bristol Siddeley BS.53 the thrust vector can be turned through 90° in less than one second.

The pilot does not need to be unduly accurate in selecting his take-off speed. For take-off distances between 500 ft. and 1,500 ft., the ground speed at the moment of nozzle deflection can be varied by ±12 kt. without adding more than 50 ft. to the total distance required to clear a 50-ft. obstacle.

The critical parameter in determining take-off performance is the thrust-loading, which is the ratio of installed thrust to the all-up weight of the aircraft. At thrust loadings near unity, a 10% reduction in installed thrust doubles the take-off distance. This highlights climatic effects; a 10% reduction in thrust would be caused by an increase of 4,000 ft. in take-off altitude, or of 30° F. in ambient temperature. This emphasizes the desirability of pre-flight power checks.

Aircraft centre-of-gravity position is another factor in VTOL engine design. If vertical take-off is needed, the lift-thrust engine will have a total rated thrust of about 120% of the aircraft's all-up weight, taking into account the total effective installation losses of about 13%. The installed weight of such a powerplant could hardly be less than 20% of the aircraft all-up weight. It is difficult to see how a practical aircraft design could be achieved if a weight of this size acted appreciably forward of the C.G. of the rest of the aircraft.

During vertical take-off the vertical-thrust line of the engine must go through the C.G. of the whole aircraft. Thus, an essential requirement is that the vertical-thrust line should act forward of the powerplant C.G. if possible. The turbofan engine gives the most simple solution to this problem.

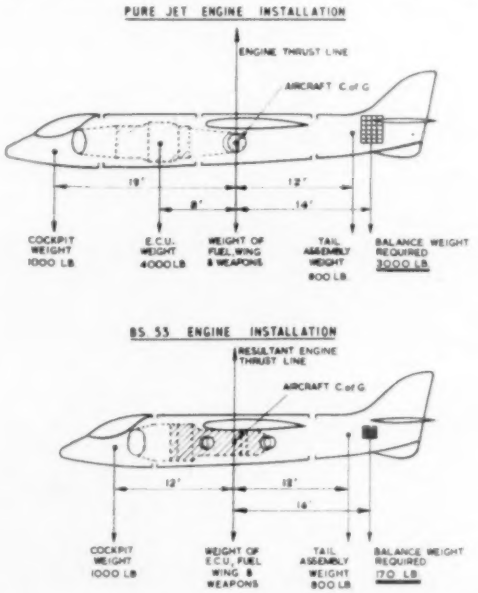
Engine Design

Thermodynamic parameters which fix the engine design are turbine entry temperature at take-off; pressure ratio of the H.P. compressor; by-pass ratio; and fan pressure ratio. Take-off turbine-entry temperature must be as high as possible to obtain the maximum ratio of take-off thrust to powerplant weight. This temperature is decided by the state of the art in materials and methods of cooling.

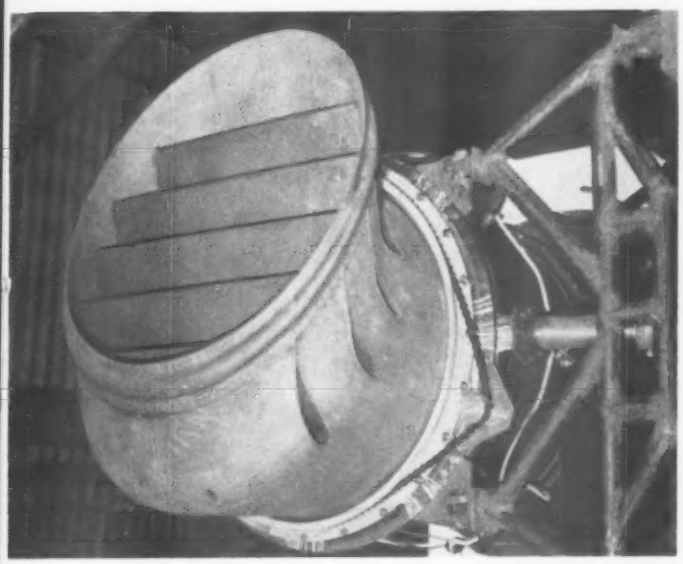
The pressure ratio of the H.P. compressor can be decided by balancing increase in engine weight against the reduction in cruising consumption. The balance depends on the mission of the aircraft. For applications so far considered, a value between 5 and 7 appears to offer the right compromise.

For the vertical-thrust line to be ahead of the engine centre of gravity, the thrust from the front nozzles should not be less than the thrust from the hot exhaust gases. This imposes a new constraint on front-fan design which is not met in conventional turbofans.

The upshot is that for purely subsonic uses a two-stage fan with a design pressure ratio of the order of 1.9 and a by-pass



BALANCE PROBLEM.—Alternative engine installations for a single-engined VTOL aircraft recognizable as the Hawker P.1127 show the difficult balance problem which would have arisen with a pure jet engine installation.



JET NOZZLE.—The turbine-exhaust thrust nozzle for the BS.53 was attached to an Orpheus turbojet for development tests; 3,000 reversals have been made.

ratio of 1.4 appears to be suitable. For supersonic aircraft, a three-stage fan with a lower by-pass ratio would be recommended, because of the increased importance of frontal area.

BS.53 Development

The four nozzles on the BS.53 are mechanically linked, the drive being provided by duplicated air motors. The pilot selects nozzle angle by means of a lever in the cockpit—the angle of the lever being transmitted to a servo device controlling the air motors. As mentioned earlier, on the present flight engines the total thrust can be deflected through 90° in less than one second; for this the air motors develop a maximum of about 2 h.p.

Early development of the bearings was carried out with a single nozzle mounted on the jet pipe of an Orpheus engine. Some initial troubles with distortion and difficulties with sealing were rapidly overcome and the latest arrangement has successfully completed 3,000 reversals.

The by-pass duct caused the most serious troubles in the early development of the engine. It leads the by-pass air from the annular exit of the fan to the circular entries of the two front rotating nozzles.

Originally the by-pass duct was developed, purely from the aerodynamic point of view, to give the lowest possible loss of total pressure. It achieved a loss coefficient of only 15%, which is a surprisingly good result considering the complicated paths through which it takes the by-pass air.

This, however, was achieved at the cost of distorting the upstream static-pressure pattern. A twice-engine-order forced vibration was thus imposed on the second-stage fan rotor blades. Strain gauges showed that the stresses so caused were unacceptably high. Excessive vibration stresses were set up at 80% fan r.p.m.; this was still far below the critical r.p.m. of 107%, at which the blades would be in tune with the excitation in their fundamental flexural mode.

Two modifications have now settled the problem. The original by-pass duct has been replaced by a plenum chamber into which two cylinders leading to the rotating nozzles have been inserted, rather like two enormous static tappings. A tremendous improvement in the upstream static pressure distribution has been achieved in this way, but the total pressure loss coefficient has been increased from 15% to 58% of the entry dynamic head, resulting in a thrust loss of 2%.

In addition, the second-stage rotor blades have been fitted with "snubbers" at approximately their mean height. These modifications lead to a mechanically acceptable engine, but an active programme is under way to eliminate the present performance penalties.

The nozzle system allows the whole thrust of the turbofan to be rotated through 90° for a thrust loss of at most 4%, compared with the performance achievable with a conventional front turbofan exhaust system. The complete weight of the exhaust system and rotating nozzle assembly, including actuation, is no greater than the weight of a conventional turbofan exhaust system, including by-pass ducting, designed to fit the same engine. The weight is precisely the same if the length of the conventional engine jet pipe is at least equal to its diameter.

Cruise Consumption

First applications of the Bristol Siddeley BS.53 are to low-level strike aircraft which, after taking off in distances between zero and 1,000 ft., will be called upon to fly at subsonic speeds at altitudes between 500 ft. and 1,500 ft. For such a requirement the *single-engined* VTOL/STOL strike aircraft is very much overpowered during low-level cruise.

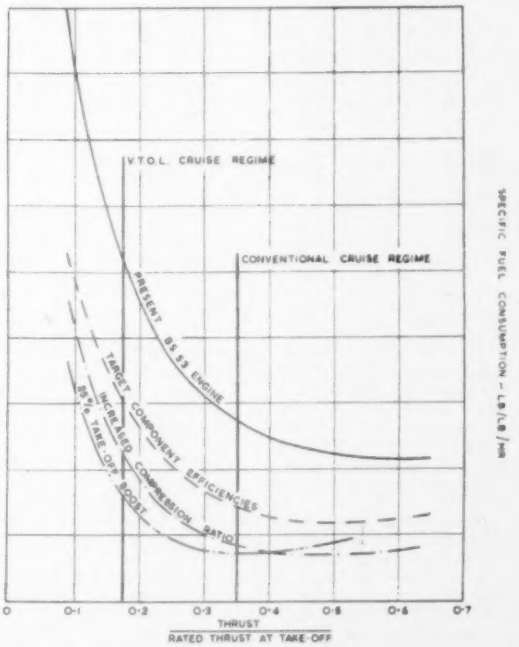
A conventional fighting aircraft can be expected to have a thrust-loading at take-off of 60%—exactly half of that required in a single-engined VTOL machine. By making a reasonable assumption for cruising lift/drag ratio, the accompanying diagram relating thrust level to specific fuel consumption shows that, at Mach 0.6, the VTOL machine will have a 25% worse cruising s.f.c. than a conventionally powered aircraft of the same all-up weight.

In the event, this must be balanced against the weight and complication of the lifting machinery, which must be added to the conventionally propelled aircraft to give it VTOL characteristics.

The same diagram shows the s.f.c. gains to be expected from improved internal aerodynamics over the next few years. Further improvements will come from take-off thrust boosting, which will allow the size of the basic engine to be reduced while retaining the same value of take-off thrust. The flatness of the lowest curve shows that the second generation of single-engined VTOL aircraft should not suffer from a poor cruise s.f.c.

Stabilization

In the case of the lift-thrust turbofan, there are two obvious sources from which compressed air can be tapped to provide



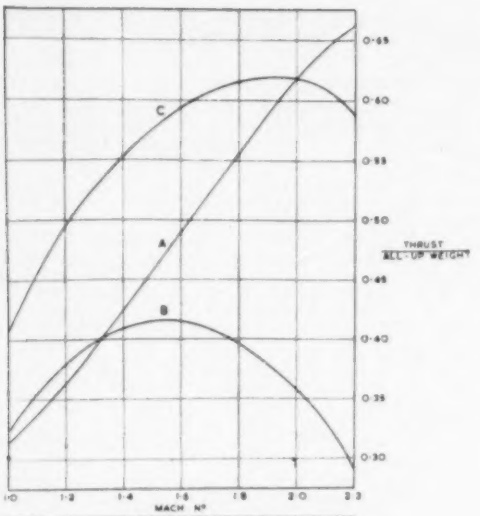
FUTURE TREND.—Developments planned for the BS.53 show the improvements likely to be effected in cruise s.f.c. of VTOL aircraft powered by a single engine of this type. The graph applies to sea-level cruise at Mach 0.6.

"puff-pipe" thrust for attitude control. One such source, at about two atmospheres, is at fan exit, the other, at 10 to 15 atmospheres, is at compressor delivery.

The low-pressure source is thermodynamically the correct one and will give the minimum overall thrust loss if the stabilizing air is all exhausted vertically downwards. But to provide stabilizing thrust with low-pressure air involves fitting bulky ducts all round the aircraft.

The high-pressure source allows the duct cross-sectional areas to be reduced by a factor of at least 10, but causes a large overall thrust penalty.

This drawback of the high-pressure bleed now used is being attacked in two ways. Methods of bleed control are being devised which take into account the time-spectrum of actual bleed utilization. They do not impose on the engine the full



	ENGINE	RATED TAKE-OFF THRUST / AIRCRAFT ALL-UP WEIGHT
A	TURBOJET WITH FULL AFTERBURNING 2000°K (3200°F)	0·70
B	DRY TURBOFAN FOR V.T.O.L. AIRCRAFT	1·20
C	TURBOFAN WITH PLENUM CHAMBER BURNING FOR V.T.O.L. AIRCRAFT 1000°K (1300°F)	1·20

ENGINE PERFORMANCE.—Comparison of thrust to all-up weight ratio for conventional turbojet aircraft and two VTOL turbofan types. Figures apply at I.S.A. conditions at the tropopause. An ideal two-shock intake and a practical nozzle are assumed.

penalty of a constant bleed operating at its maximum value during the whole take-off. In this way the thrust penalty due to bleed could be approximately halved.

In addition, methods of bleed "boosting" are being studied. By heating the bleed air immediately upstream of the control nozzles a further halving of the penalty is possible in principle.

Supersonic VTOL

The disadvantage of the large size of a single lift-thrust turbofan engine during subsonic cruise at sea level can be turned to advantage in the high-level supersonic cruise case. In the diagram above, curve A shows the tropopause thrust of a conventional jet engine with maximum afterburning. The thrust is given as a fraction of the aircraft all-up weight by assuming a take-off thrust loading of 0.7, a reasonable value for a modern supersonic military aircraft.

Curve B shows the performance of an unreheated lift-thrust turbofan engine powering a VTOL aircraft with a take-off thrust loading of 1.2. In spite of its much greater thrust at take-off, the unreheated turbofan thrust falls off too rapidly with forward speed to be useful anywhere around Mach 2.

Curve C, however, shows the effect of giving the turbofan "a shot in the arm" by burning some fuel in the by-pass air and raising the front-nozzle exit temperature to 1,000° K. (1,300° F.). This temperature is similar to the temperature in a conventional unreheated turbojet tail pipe and is very much lower than the 2,000° K. (3,200° F.) produced by modern afterburners.

Even with the modest degree of by-pass burning assumed, the lift-thrust turbofan provides a very powerful means of supersonic propulsion. In particular, the transonic acceleration of an aircraft so powered should be exceptionally good.

The required degree of "by-pass burning" can be achieved with the available airflows and used with the rotating nozzle system, so that it can be used for VTOL phases as well as for high Mach number propulsion.

Considering specific fuel consumption in the supersonic régime, another diagram (right) shows that the turbofan again scores against the pure jet. Thrusts have been expressed as fractions of the aircraft all-up weight by using the same assumptions as for the previous diagram.

Over the whole range the turbofan can be seen to have specific fuel consumptions which are better than those of the afterburning turbojet—by 20% in the case most favourable to the turbofan. Specific fuel consumption of the turbofan is very nearly constant over a 2 : 1 range of thrust.

The main drawback of the lift-thrust turbofan is its very large air consumption. Consider two aircraft of the same all-up weight, one powered by a conventional afterburning pure-jet engine with take-off thrust loading of 0.70 and the other using a turbofan with by-pass burning, but with a take-off thrust loading of 1.20, which is sufficient for VTOL.

In this case the turbofan consumes about three times as much air as the corresponding turbojet and the intake capacity must, therefore, be three times greater, with resultant penalties in drag and intake weight. But it can be shown that with well-designed intakes these penalties are more than compensated by the greater efficiency of the turbofan cycle.

Transports

Neglecting take-off and landing considerations, it is now accepted that the correct engine for high subsonic transports is the turbofan, because of its good fuel consumption. The Bristol Siddeley BS.53 rotating nozzle system could be fitted to such an engine without noticeably increasing powerplant weight. The whole propulsive thrust could then be rotated at the cost of only the slight performance penalties involved in the nozzle system.

It will be uneconomic to increase the size of propulsive engines beyond a take-off thrust loading of about 40-50%. If very short, or vertical, take-off is required, the lift-thrust engines must be supplemented by special lifting engines and/or by some method of increasing wing lift. But even without these aids, the ability to rotate propulsive thrust will lead to 50% reduction in the take-off and landing run.

When used in combination with special lifting engines, which could be pod-mounted on the wing-tips, the lift-thrust turbofan engine has many advantages for transport aircraft. Large quantities of high- or low-pressure air can be tapped for stabilization or wing flow-control techniques. Reverse thrust can be provided without further weight penalty.

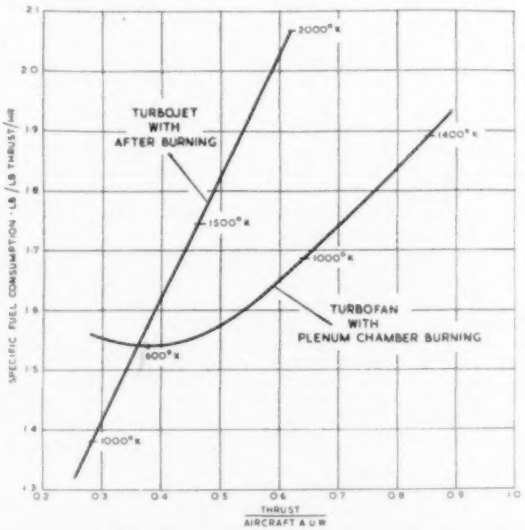
The rapid thrust rotation of the lift-thrust engine allows additional safety to be built into V/STOL transports. If the aircraft is designed to take off without the lift-thrust engines acting vertically, any failures of the pure-lift engines can be counteracted by further lowering of the lift-thrust engine nozzles.

Future Trends

At Bristol Siddeley the development of lift-thrust turbofans is concentrating on the improvement of specific fuel consumption and techniques to boost take-off thrust.

The lift-thrust turbofan used in V/STOL aircraft of all types will tend to be cruised at uneconomical throttle settings. The most effective way to improve this situation is by achieving better s.f.c. This is being done by a process of aerodynamic refinement—to increase all the component efficiencies.

The other approach is to devise methods of increasing the take-off thrust. These will allow the basic engine to be made smaller and so to be operated more efficiently at cruise. Devices such as air-cooled turbines and improved methods of water injection are being actively investigated, as well as various schemes for by-pass burning and for afterburning in the hot exhaust system.



THRUST BOOST.—By-pass air reheat allows the thrust of a turbofan to be boosted considerably. Figures apply to Mach 2 at the tropopause and I.S.A. conditions.

The Fighting Services

Standard for No. 101 Squadron

H.R.H. PRINCESS MARGARET is to present a Standard to No. 101 Squadron (Wg. Cdr. W. J. H. Roberts) at R.A.F. Finningley on Tuesday, Jne. 6. The squadron extends to all former members a cordial invitation to attend the ceremony, and those wishing to do so should communicate as soon as possible with the Adjutant, No. 101 Squadron, R.A.F. Finningley, Doncaster, Yorkshire.

First formed at Farnborough in July, 1917, the squadron operated in France as a night-bomber unit. Disbanded in December, 1919, it re-formed in April, 1928. The only squadron to be equipped with Boulton Paul Sidestrands and Overstrands, No. 101 was operating Blenheims from R.A.F. West Raynham at the start of the Second World War. It started bombing operations against Germany in July, 1940.

Re-equipped with Wellingtons in June, 1941, No. 101 Squadron raided Italy for the first time in September, 1941, and took part in the first thousand-bomber raid against Cologne in May, 1942. The following October it re-equipped with Lancasters and took part in radio counter-measure operations. Its last bombing attack by 24 Lancasters was made in April, 1945.

In 1945 No. 101 was based at R.A.F. Binbrook with Lincolns and six years later it became the first Bomber Command Canberra squadron. Disbanded in January, 1957, it re-formed the following October at R.A.F. Finningley with Vulcan B.1s.

Air Rank Changes

AIR VICE-MARSHAL R. N. BATESON, D.S.O., D.F.C., is to become Air Officer Commanding, No. 12 Group, Fighter Command, in June. He will be succeeded as Assistant Chief of the Air Staff (Operational Requirements) at the Air Ministry by Air Vice-Marshal C. H. Hartley, C.B.E., D.F.C., A.F.C.

Assistant Chief of the Air Staff (Operational Requirements) since September, 1959, Air Vice-Marshal Bateson was previously with the NATO Standing Group in Washington. Between 1953-55 he was Deputy Director of Operations (Air Defence) at the Air Ministry.

Air Vice-Marshal Hartley has been A.O.C., No. 12 Group, since August, 1959. Prior to that he was Senior Air Staff Officer of the Group.

Air Commodore L. A. Jackson, C.B.E., who until recently was with the Logistics Division at Headquarters, Allied Forces Central Europe, has been appointed Director of Logistics (Forecasting and Planning) at the Air Ministry. Before going to Allied Forces Central Europe he was Senior Equipment Staff Officer at Technical Training Command.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Gp. Capt. L. A. Wear, O.B.E., to the Department of the Air Member for Supply and Organization; Wg. Cdr. A. Ashworth, D.S.O., D.F.C., A.F.C., to the Department of the Chief of the Air Staff; Wg. Cdr. W. H. McCulloch, to the Department of the Air Member for Personnel; Wg. Cdr. G. M. Beer, Wg. Cdr. G. H. D. Evans, D.S.O., D.F.C., and Wg. Cdr. J. B. Yates, to the Department of the Air Member for Supply and Organization.

Bomber Command: Gp. Capt. J. S. Laird, O.B.E., to Headquarters as Command Work Study Officer; Sqn. Ldr. J. W. Pettigrew to R.A.F. Feltwell to command the Technical Wing, with acting rank of Wg. Cdr.

Fighter Command: Wg. Cdr. G. Tate, O.B.E., D.F.C., to Headquarters for fighter control duties.

Transport Command: Gp. Capt. I. D. N. Lawson, D.F.C., to R.A.F. Lyneham to command.

Coastal Command: Wg. Cdr. P. H. Stembridge, D.F.C., A.F.C., to R.A.F. Kinloss to command, with acting rank of Gp. Capt.

Technical Training Command: Wg. Cdr. W. C. Armstrong to No. 12 School of Technical Training, Melksham, to command the Administrative Wing; Sqn. Ldr. S. W. Cornes to No. 1 Radio School, Locking, to command the Training Wing Headquarters, with acting rank of Wg. Cdr.; Sqn. Ldr. J. Ford to Headquarters for training duties, with acting rank of Wg. Cdr.

Far East Air Force: Sqn. Ldr. J. K. Holt to Headquarters for operations duties, with acting rank of Wg. Cdr.

Other Appointments: Gp. Capt. P. H. Baldwin, O.B.E., to Rio de Janeiro as Air Attaché; Gp. Capt. K. J. Powell to the Ministry of Aviation, Aldermaston, as Senior R.A.F. Adviser; Wg. Cdr. G. Cubby, M.B.E. to Headquarters, 3rd Air Force, U.S.A.F.(U.K.) as R.A.F. Liaison Officer; Wg. Cdr. J. R. Ritchie, A.F.C., to Northern Army Command as R.A.F. Liaison Officer; Wg. Cdr. A. D. Dick, A.F.C., to the R.A.F. Staff College, Andover, for directing staff duties; Wg. Cdr. L. A. A. Butler to Bangkok as Planning Officer, S.E.A.T.O.; Wg. Cdr. H. A. Jenkins, D.F.C., to Allied Air Forces Central Europe for operations and training duties; Sqn. Ldr. D. A. McF. Walker, M.B.E., to Allied Air Forces Central Europe for operations duties, with acting rank of Wg. Cdr.

The R.A.F. "At Home"

THIS year "Battle of Britain" week will be from Sept. 11 to 17. On Saturday, Sept. 16, a total of 16 R.A.F. stations are to be open to the public. These are:—

Berkshire: Abingdon; **Kent:** Biggin Hill; **Devon:** Chivenor; **Wiltshire:** Colerne; **Norfolk:** Coltishall; **Rutland:** Cottesmore; **Yorkshire:** Finningley; **Warwickshire:** Gaydon; **Durham:** Middleton St. George; **Sussex:** Tangmere; **Lincolnshire:** Waddington; **Cambridgeshire:** Waterbeach; **Scotland:** Leuchers; **Wales:** St. Athan and Valley; **N. Ireland:** Aldergrove.

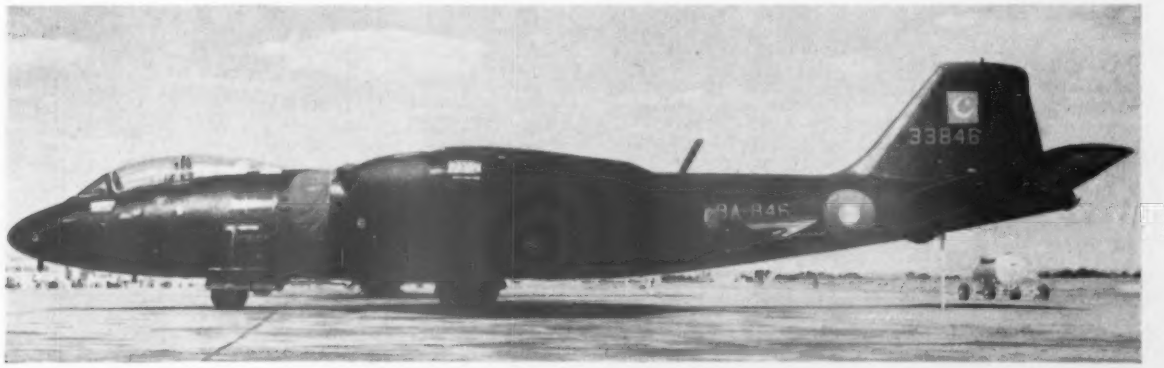
More Service News

No. 264 Squadron Reunion.—This year's meeting of the No. 264 Squadron Dinner Club will be held at the Milestone Hotel, Kensington, on May 26. Members who have not received details should contact Flt. Lt. R. C. Olding, Officers' Mess, R.A.F. Bassingbourn, Royston, Herts.

Search and Rescue.—Under a general re-deployment policy the No. 22 (Search and Rescue) Squadron detachment at R.A.F. Felixstowe is moving to Tangmere, while an additional detachment is to be formed to operate from Manston. The Felixstowe area will be covered by the No. 228 Squadron detachment at Horsham St. Faith and the No. 22 Squadron detachment at Manston. Both squadrons are to re-equip with the Mk. 10 Gnome-powered Whirlwind later this year.

Education Branch Dinner.—The annual dinner of the R.A.F. Education Branch was held earlier this month at Overseas House, St. James's, with the Director of Educational Services, Air Vice-Marshal E. Knowles, in the chair. Air Chief Marshal Sir Thomas Pike replied to the toast of "The Guests" proposed by Air Cdre. J. R. Morgan.

No. 65 Squadron.—No. 65 Squadron was disbanded at R.A.F. Duxford on Mar. 31. Its Standard was to be laid-up in St. Clements Danes Church on Apr. 18.



PAKISTAN B-57C.—Photographed in Bangkok recently during SEATO exercises, this Martin B-57C dual-control trainer is the personal aircraft of the C.-in-C., Pakistan Air Force. It is still in its all-black American colour scheme. The Indian Air Force operates British-built English Electric Canberra B.8s, PR.7s and T.4s.

Ninety-two Preview

"Wren" visits the Squadron

Sqn. Ldr. Brian Mercer, A.F.C., C.O. No. 92 Squadron.

Flt. Lt. Frank Grimshaw
Flt. Lt. Channing Bate
Flt. Lt. Tony Aldridge
Flt. Lt. 'Jorj' Aylett
Flt. Lt. Hamid Anwar P.A.F.
Flt. Lt. Chips Carpenter
Flt. Lt. Derek Gill
Flt. Lt. Bill Stoker
Flg. Off. Don Camden
Flg. Off. Peter Taylor

FROM what I have recently seen at R.A.F. Station Middleton St. George, the high standard of aerobatics which No. 111 Sqn. set during the past four years will be maintained by their successors, No. 92 Sqn., commanded by Sqn. Ldr. B. P. W. Mercer, A.F.C., one of the R.A.F.'s most experienced aerobatic leaders. He headed No. 60 Sqn.'s team of Venoms in the Far East and, as deputy leader of Treble-One for two years, often led a section of the "Black Arrows" and sometimes the full team, for which he received the A.F.C.

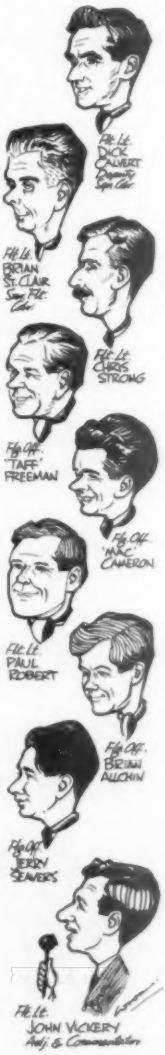
Along with Brian Mercer, four other Treble-One pilots have joined 92, the squadron which provided the R.A.F.'s No. 2 team last year, so that the group of 19 pilots, who will take it in turns to fly in the team, has a solid nucleus of 92's and 111's old hands. Flt. Lt. Hamid Anwar, on exchange from the Pakistan Air Force, flew in the P.A.F.'s team which looped 16 Sabres some years ago and was photographed by THE AEROPLANE photographer, George Moore, over Mauripur.

Almost inevitably, the team's show contains traditional formations, such as echelon, as well as some of those devised by Roger Topp and Peter Latham—Wineglass, Swan, Fork, etc., and not forgetting the spectacular bomb burst. To this, 92 have added Diamond 9, Arrow, Delta and T, the last having seven in line abreast, which I saw them do beautifully, a difficult formation to space evenly in aircraft whose swept wing-tips cannot be seen by the pilots. Although the basic patterns use all nine aircraft, Brian plans to work up a co-ordinated 3-team show, with three and perhaps four aircraft in each team. White smoke will be used to emphasize patterns and the Sqn. Adj., Flt. Lt. John Vickery, will do the commentaries.

Turning to the aircraft, blue was reckoned to be the best and indeed about the only possible new colour for the Avon-powered Hunter 6s and after the first mild shock, one comes to accept the all-over deep, rich blue, and the squadron's red and yellow checker marking on each side of their cobra-and-maple-leaf badge, painted on the nose. A white lightning flash runs the length of the fuselage, and the wing-tips are painted white, not only for aesthetic reasons but also for the same reason that No. 19 Sqn., the other Hunter squadron at Middleton, paint *their* wing-tips white—to help formating pilots to see the other aircraft in the sometimes thick murk which pervades their part of England. Because the squadron cannot spare the men to do it, 92's Hunters are flown to Marshall's of Cambridge to have their exotic decor applied. At displays, white overalls will be the order of the day for air and ground crews, and pilots will wear scarves in the squadron's colours, red and yellow.

It is a sign of the march of time that the Hunter, now of limited operational value, will not represent the R.A.F. at displays to the degree that Treble-One did, but will share the glory with the supersonic Lightning. At the Paris Show, there will be no Hunter display, to the regret of all, and at the S.B.A.C. Display, 92 are scheduled to fly for only five minutes.

It seems possible that by next season, a Lightning aerobatic team may entirely supersede the Hunters. In the meantime, British lovers of beautiful aeroplanes beautifully flown should try to see the squadron's displays at North Weald Hucknall and Yeadon, all on Whit-Monday, and subsequently at Baginton, Bristol, Edinburgh, Hullavington, Farnborough and at Battle of Britain Displays. Their first public displays will be at Wildenrath, Germany, on Apr. 22 and Bergen, Norway, on May 7. Later in May, 92 move their base to Leconfield.


Flt. Lt. Dick Calvert
Flt. Lt. Brian St. Clair
Flt. Lt. Chris Strong
Flg. Off. 'Taff' Freeman
Flg. Off. 'Mac' Cameron
Flt. Lt. Paul Robert
Flg. Off. Brian Allchin
Flg. Off. Jerry Seavers
Flt. Lt. John Vickery Adj. & Commentator

THEY KEEP THEM FLYING.—Ch. Tech. C. Bowtell, Sgt. E. Wilson, Flt. Sgt. C. Rutter, Flg. Off. J. Griffiths (E.O.), W. O. H. Cooper, Flt. Sgt. F. O'Brien.

Greater Operational Freedom

Radar surveillance and control, or the lack of it, is one of the most important factors governing the amount of operational freedom that an airfield can obtain for its aircraft. In this article the special A.T.C. procedures at two private radar-equipped airfields are described.

ALTHOUGH there are estimated to be a total of 300 aeronautical radar installations of various types deployed within the United Kingdom at the present time, the vast majority of these are employed in three main rôles—civil air traffic control tied to the fixed-route system of Airways and Control Zones; military operations under general area radar; and the joint military/civil upper airspace (above 25,000 ft.) control service. The remainder comprising mainly local airfield control units together with a few more powerful surveillance radars, are in use on a limited basis at the smaller civil airports and airfields operated by members of the aircraft industry.

These latter radars are more than proving their worth in terms of safety and independence for their operators. In addition to providing navigational and local surveillance cover for aircraft using airfields within their operational range in uncontrolled airspace, they also enable a limited amount of operational freedom to be obtained for airfields situated within controlled areas.

In particular, operators with radar-equipped airfields within the London Terminal Control Area—such as Vickers-Armstrongs at Wisley and de Havilland at Hatfield—are considerably better placed than those without such facilities. This especially applies to Vickers-Armstrongs flight-test centre at Wisley which, in addition to being within the control area and less than nine miles from London (Heathrow) Airport, is also on the southern boundary of the London Control Zone.

When the first radar—a Decca 424—was installed at Wisley eight years ago the (then) Ministry of Supply agreed to a special control procedure for aircraft operating from the airfield. This agreement has been modified over the years as new control facilities have been introduced by the company, or as changes have taken place in the operation and status of U.K. controlled airspace. For example, there has been the acceptance of the Decca MR.100 terminal surveillance radar installation at Wisley; in September, 1958, and the recent introduction, on Mar. 1, of full IFR requirements in all weather conditions for aircraft flying within the London Control Zone and on Airways.

The Decca MR. 100, a simplified and modified version of the company's D.A.S.R.1 terminal area surveillance radar, gives complete coverage out to 85 n. miles at 40,000 ft. and navigational cover for fighter aircraft, such as the Scimitar, to a radius of 120 n. miles at the same altitude. At Wisley there are two MR. 100 display and control units, one of which is normally set at 80 n. miles range and the other at 30 n. miles. Navigational and other information is obtained with the aid of an interscan range and bearing strobe line which can be off-centred to any point on the display.

HATFIELD RADAR.—Situated in the tower, the Hatfield radar control room contains this Marconi S.232 twin display console. The radar is employed for general aircraft surveillance work as well as an airfield approach aid.

In addition to general surveillance and navigational requirements, Wisley A.T.C. employ the MR. 100 for normal circuit work and aerodrome control. The 424, a general airfield control radar, is used entirely as an approach aid.

The 2,300-yd. runway at Wisley lies on a heading of 10/28. Take-off is usually on 28 and, depending upon the actual weather conditions, either full radar control or radar monitoring is maintained on all Vickers aircraft—flight testing usually taking place in the uncontrolled airspace between Airways Red One and Green One.

Special Control Procedures

Prior to Mar. 1, Wisley radar could monitor aircraft through the London Control Zone, but, with the introduction of IFR requirements at all times, clearance now has to be obtained from London Airways before the area can be penetrated. However, Wisley radar still has special permission to control aircraft through Airways under the now continuous IFR conditions.

AIRFIELD SURVEILLANCE.—The two display and control units of the Decca MR. 100 surveillance radar at Wisley. The left-hand display is normally set at 80 n. miles range and the right-hand at 30 n. miles.

Vickers aircraft can also cross the London Terminal Control Area above 11,000 ft. in VMC when authorization has been granted and full radar cover has been established by Wisley.

Radar-controlled descents and approaches are undertaken at Wisley with aid of the MR. 100 and the 424 down to a weather minima of 400 ft. cloudbase and one mile visibility for all turbojet aircraft, and 300 ft. and 900 yd. for turboprop and piston-engined types. After positive identification with the MR. 100 the radar controller directs the aircraft under VFR conditions "on top" for as long as possible before giving descent instructions in the area south-west of Wisley, which is clear of controlled airspace and conflicting R.A.E. Farnborough traffic. If full PPI talkdown is requested, the aircraft is handed over from the MR. 100 when positive identification has been established on the 424.

Instrument approaches can only be made on to runway 10 and, under a strong tailwind component (above 10 knots), aircraft overshoot for a visual circuit below 1,500 ft. under radar monitoring on to runway 28.

Situated just over four miles inside the north-eastern

boundary of the London Terminal Control Area, the de Havilland airfield at Hatfield is equipped with a Marconi 50 cm. Type S.232 general-purpose terminal area surveillance radar and Pye ILS on the single 24/06 runway. Twin PPI presentations, one of which is normally set at 40-n. miles range and the other at 15 n. miles, are employed with the S.232 radar and the ILS, which has no back-beam, is equipped with a boundary and outer marker only.

Hatfield Cover

Practical experience has shown that the Hatfield S.323 radar installation provides positive cover against the smallest targets up to a range of 30 n. miles at 6,000 ft., going up to 30,000 ft. with "finger" gaps. The S.323 also enables navigational assistance only, without complete surveillance cover, to be given to large aircraft out to an approximate maximum range of 75 n. miles. For approach guidance, the S.323 can be used down to ¼ mile from touchdown; its accuracy at 1 mile being within 200 ft. on each side of the extended centre-line of the runway.

During VFR weather conditions aircraft can make normal circuits, landings and take-offs; but, under IMC, Hatfield radar undertakes aircraft identification and marshalling outside controlled airspace prior either to a free entry below 1,500 ft. into the airfield circuit, a radar-controlled approach, or an ILS radar-monitored approach on to runway 24. When runway 06 is in use, aircraft making an ILS approach overshoot for a radar-monitored circuit and landing.

All aircraft operating from Hatfield go out on a north-east heading under radar cover until clear of controlled airspace, when they are given climbing instructions, but navigation to the airfield varies according to type and airborne aids.

Those equipped with TACAN, such as Sea Vixens and Lightnings, use the Wethersfield beacon for positioning and homing to within the scope of Hatfield radar coverage. Comets home on the Stansted NDB from the north, intercept the Hatfield ILS localizer, and turn starboard for a normally coupled ILS approach. Visiting aircraft not carrying such aids call Hatfield when within R/T range and give a position report so that they can be identified outside controlled airspace and their radar monitored to the airfield.

The new IFR requirements in the London Control Zone and on airways have not seriously affected flying at these two radar-equipped airfields. The possible extension of the north-eastern and south-western boundaries of the London Terminal Control Area, or the introduction of IFR all-weather requirements for the control area, would not necessarily introduce new problems if their special radar-control agreements were to be modified to allow for such future contingencies.

Exporting Technical "Know-How"

FOR the past 13 years International Aeradio, Ltd., has been successfully engaged in an export operation of prime significance. This is in the provision of technical "know-how" to assist the growth of under-developed and newly independent countries.

International Aeradio, Ltd., operates on a commercial basis and receives no subsidy in connection with its activities. All operations are undertaken by negotiated contracts with customers, be it government department, administration or airline.

In any operating contract with an overseas government or administration, whereby International Aeradio operates the airport facilities, it is part of the company's policy to train local nationals to a standard which will eventually enable them to operate the airport entirely. This covers not only "on the job" training, but also specialized courses in the United Kingdom, which have been at the company's expense. The success achieved can be gauged by the fact that some 85% of I.A.L.'s staff are local nationals.

The air radio facilities in Burma are now completely manned by Burmese nationals, the company having handed over as long ago as Dec. 31, 1957. The same applies to the facilities in the Sudan, the Sudan Government was in a position to take over on Dec. 31, 1958.

Training of local nationals is proceeding in the following localities where I.A.L. have contracts:— Aden, Arabian Gulf, Caribbean Area, Cyprus, East Africa, Fiji, The Gambia, Ghana, Libya, Malta, Nigeria, Sierra Leone, Singapore and Somalia.

In addition, training schools have been established and operated at various times by International Aeradio during the past 13 years in:— Belgium, air traffic control school; Iraq, radio and radar training school, A.T.C. training; Italy, air traffic control training school; Lebanon, radio training school; Libya, radio training school; Pakistan, radio and radar training school, A.T.C. school; Portugal, A.T.C. training; Syria, radio and radar training school.

Negotiations are now in hand for the establishment of new training schools in various parts of Africa.

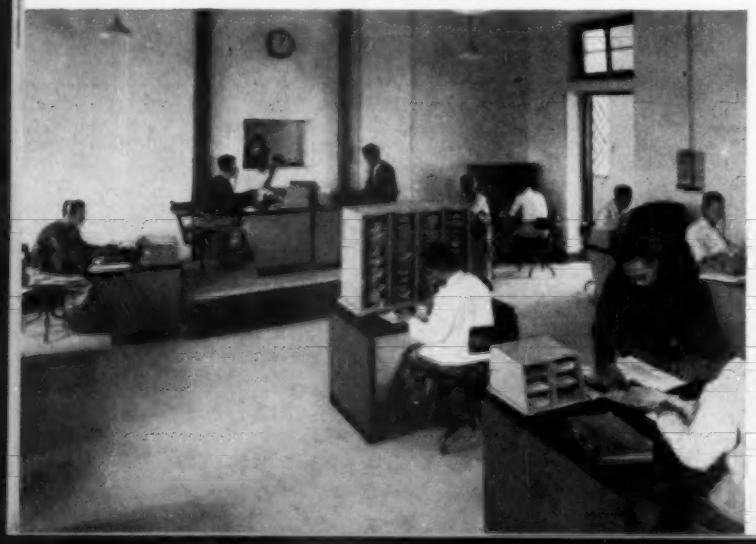
I.A.L. has established in the United Kingdom its own air traffic control school which includes simulators for procedural A.T.C. and radar purposes, and also a radio training school; the facilities of both schools are open to overseas pupils.

It must be emphasized that this direct export of technical "know-how" has been achieved entirely by the company's own efforts—no financial aid has been received from any outside organization and the necessary negotiations have been instigated and finalized by the company.

International Aeradio is owned by the airlines. The principal shareholders are B.O.A.C. and B.E.A., other shareholders being major international operators—Alitalia; Aeronautical Radio Incorporated; Air France; Air-India International; Australian National Airways; British United Airways; K.L.M. Royal Dutch Airlines; Middle East Airlines; Pan-American World Airways Incorporated; Qantas Empire Airways; Scandinavian Airlines System; Sabena; Skyways, Limited; Swissair; Trans Canada Airlines; and Trans World Airlines Incorporated.

Right, Antonio Uravaru, I.A.L.-trained, in the control tower at Fiji's domestic airport, Nausori.

Left, signals centre at Rangoon. Below, point-to-point and air guard signals office at Khartoum Airport. At both places I.A.L. planned the services and trained the operators.



Man's First Orbit in Space

by K. W. Gatland

MAJOR YURI ALEXEYEVITCH GAGARIN'S space journey will be long remembered as marking the beginning of an entirely new era of human conquest and discovery. Many manned flights will be made in the future, but this first "quantum jump" will certainly be the most durable in human memory.

When it comes to the first reconnaissance mission around the Moon, and even when its ancient dust receives the first imprint of man, these events will emerge as the result of experience building up over the years, involving flights of longer duration and at greater distances from Earth, and even the achievement of the first Lunar landing will come about almost as an anti-climax—as the inevitable result of what has gone before.

First news that a man was orbiting the Earth came from Moscow radio at 07.00 G.M.T. on Apr. 12 when listeners were asked to stand by for an important statement. This ran:—

"The World's first space-ship Vostok with a man on board was launched into orbit from the Soviet Union on Apr. 12, 1961.

"The pilot space navigator on the satellite space-ship Vostok is a citizen of the U.S.S.R., Flight-Major Yuri Alexeyevitch Gagarin.

"The launching of the multi-stage space rocket was successful and after attaining the first cosmic velocity and the separation of the last stage of the carrier-rocket, the spaceship went into free flight on a round-the-Earth orbit.

"According to preliminary data, the period of the revolution of the satellite-spaceship around the Earth is 89.1 minutes. The minimum distance from the Earth (at perigee) is 175 kilometres (109 miles) and the maximum (at apogee) is 302 kilometres (187 miles); the angle of inclination of the orbit plane to the Equator is 65 degrees 4 minutes.

"The spaceship with the navigator weighs 4.725 kilograms (10,395 lb.) excluding the weight of the final stage of the carrier-rocket."

Inclined Orbit

A reconstruction of the orbit is shown in Fig. 1, which shows the operation in three phases. The first drawing indicates the launching site in the Soviet Union, tracing the departure trajectory eastward; the second indicates the passage of the spacecraft around the back of the Earth, and the third indicates the path of re-entry some hundreds of miles westward of the point of departure. Fig. 2 shows the orbit as a flat projection.

The entire operation lasted just 108 minutes. It began at 7.07 B.S.T.; by 8.15 Major Gagarin had reported that he was over Africa, at 8.25 the retro-rocket fired to start the descent, and at 8.55 the spacecraft was back on the ground with its occupant safe and well. The discrepancy involved in the statement that the spacecraft was over S. America at 7.15 B.S.T. has not yet been explained.

Why did the spacecraft make only one orbit before returning? The answer is not difficult to find. Apart from minimizing the chances of things going wrong, the single orbit was necessary to ensure descent in the desired recovery area within the Soviet Union. Because of the Earth's rotation about its axis, the launching point is displaced to the east to the extent that if recovery were attempted, say after four or five orbits, the vehicle would descend outside the borders of the Soviet Union. To bring the recovery area back into correct alignment with the spacecraft's orbit, the vehicle would have to spend much more time in space. This was, in fact, the case with the two dogs Strelka and Belka, launched in Spacecraft II on Aug. 19 last year, which made about 18 orbits before being returned after a period of some 24 hours. As it happened, the dogs were successfully recovered the next day a few miles from the designated landing point in the U.S.S.R., but an orbital flight of this duration was obviously too much to expect for an initial manned experiment.

The journey of these two dogs, with smaller test animals, insects and plants, etc., was preceded on May 15 by the launching of a spacecraft said to contain a "dummy astronaut." The Russians made it clear that this vehicle would not be recovered but would be allowed to burn up in the atmosphere. However, when the re-entry signal was given, the retro-rocket which should have started the spacecraft on its descent trajectory, fired in the wrong direction because of an orientation fault, and instead sent the vehicle into a higher orbit. At the same time it separated into two parts.

After the successful return of Strelka and Belka on Aug. 20 the Russians released the first technical information concerning the nature of their experiments (Ref. 1). It seems worth while to recall what they disclosed, as the manned vehicle must owe much to the successful outcome of these earlier experiments.

The spacecraft containing the dogs, they said, was orientated in orbit so that its retro-rocket acted to slow down the vehicle and start it on its descent path. To minimize the effects of deceleration on the animal occupants, the retro-rocket was fired when the space-vehicle was still some 7,000 miles from the

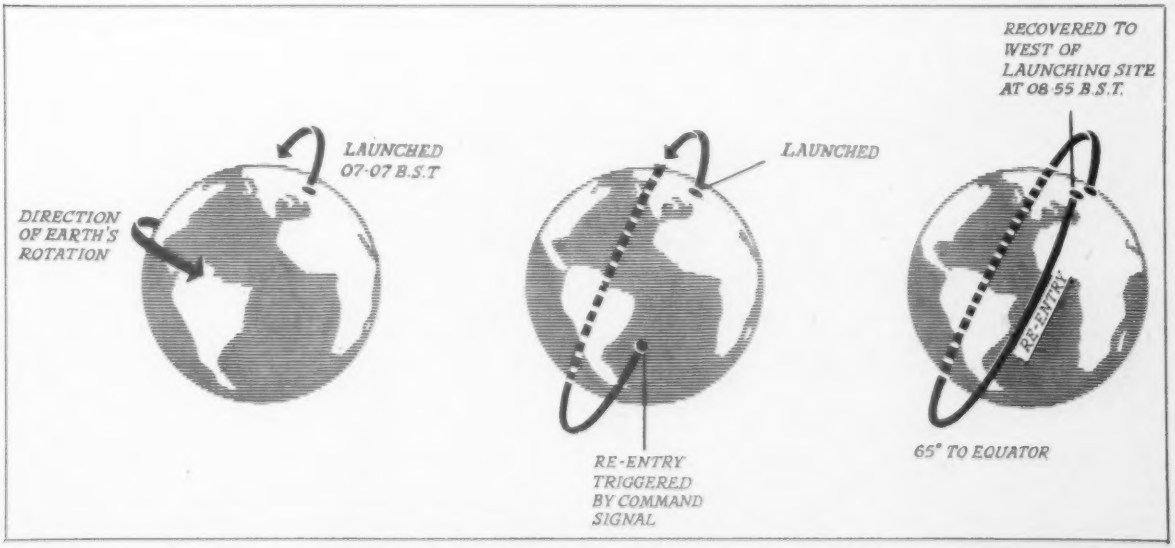


Fig. 1. The 108 minute space-journey seen in three stages, according to information supplied by Soviet news sources. Because of the Earth's eastward rotation, the landing in the Soviet Union would have been made west of the launching point.

A colleague of Major Gagarin's, Gennady Mikhailov, prepares for a simulated high-altitude test at a space-medical research centre.

appointed landing area in Russia. Maximum deceleration during this period was stated to be about 10*g*.

After the retro-rocket had fired, an "instrument compartment" containing devices which had already operated during orbital flight was jettisoned to reduce the mass of the re-entering spacecraft and allowed to burn up in the atmosphere. These included telemetry apparatus, equipment for guiding the vehicle while in orbit, part of the scientific equipment for studying cosmic rays and short waves emitted from the Sun; temperature control apparatus, and "a powered deceleration unit."

Of the spacecraft's total weight of 10,008 lb., the pressure cabin has been said to have accounted for 5,512 lb., and the instrument compartment 3,250 lb., which would leave only 1,246 lb. for the spacecraft casing, including the protective heat shield (!)

At an altitude of between 23,000 and 26,000 ft., the "cap of the ejection trap" was jettisoned by barometric relays and the pressure cabin containing the animals was ejected from the ship. The cabin, it was stated, touched down at a speed of 20-26 ft./sec., while the spaceship itself landed at nearly 33 ft./sec.

The Russians explained that separation of the two components was an emergency procedure, used on this occasion to test the escape system before manned flights were attempted. They also stressed that the animals would have landed safely if the pressure cabin had not separated from the spaceship.

Re-entry accuracy

The statement that the two components landed only 6½ miles from the pre-arranged launching centre represents a very high order of guidance accuracy. "The ship," the Russians explained, "was guided automatically as well as by command from Earth. It was equipped with a high-precision orbit control system." The orientation system was active both during orbital flight and throughout the descent. An error of only 3 ft./sec. in speed, would have deflected the vehicle over 30 miles. And an error of about 300 ft. in estimating the vehicle's height above the Earth would have resulted in a deflection of nearly three miles. Finally, an error of one minute of arc in attitude would have meant a deviation of 30-40 miles.

Concerning the spacecraft itself, we still do not have all the details. On the exterior of the vehicle were control jets and the "orientation system's reserve high-pressure gas containers." Also on the exterior "were the transducers of the scientific apparatus, the radio aerials and the experimental solar batteries, and also a system of heat insulation to prevent the ship from burning up during the descent."

Apart from receiving command signals from the Earth, the vehicle "was guided automatically by means of a precision orbit-control system." Apparatus aboard the craft was powered by both chemical and solar batteries, the latter being "placed on two half-discs one metre in diameter" which remained locked on the sun irrespective of the vehicle's attitude or position.

Within the pressurized cabin, air pressure had to be maintained close to the sea level value, with an oxygen concentration of from a fifth to a quarter and not more than 1% of carbon dioxide. Air temperature had to be kept between 60° and 80° F., and its relative humidity content between 30% and 70%.

In order to maintain the correct oxygen balance in the cabin, it was said that "special devices were devised which automatically regulated the speed of absorption of carbon dioxide

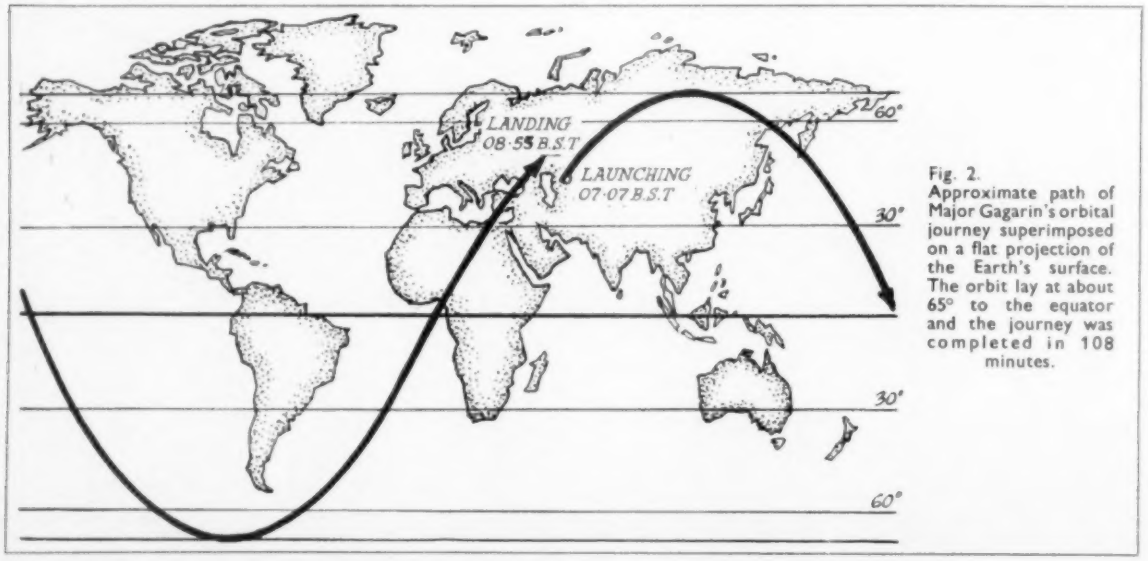
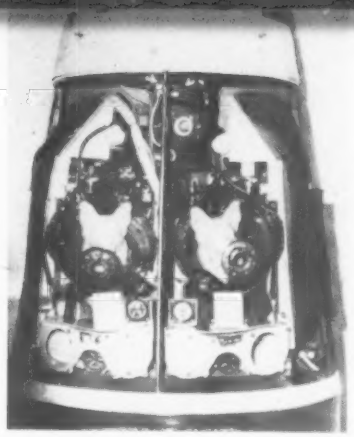
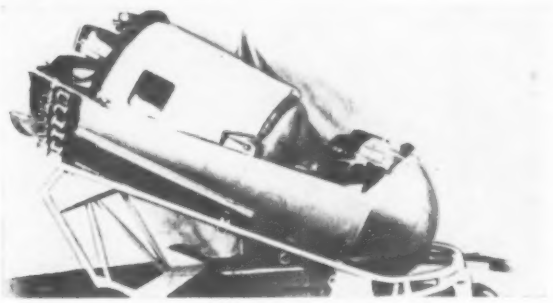


Fig. 2. Approximate path of Major Gagarin's orbital journey superimposed on a flat projection of the Earth's surface. The orbit lay at about 65° to the equator and the journey was completed in 108 minutes.



Method of housing two dogs in ejectable chassis in the payload section of a Russian geophysical rocket.



Below, the capsule in which Strelka and Belka were recovered from orbit on Aug. 20, 1960.

and water vapour with the emission of appropriate quantities of oxygen." Any decrease in oxygen and increase in carbon dioxide concentration was registered by gauges which fed signals into the telemetering equipment and a control unit. A liquid-air radiator was employed to remove heat from the cabin. Temperature of the instrument compartment, and the stable temperature of the refrigerant, were maintained by means of a heat exchanger and a louvre system.

So much for Spacecraft II. As our table of the Soviet space programme shows, there were three further animal experiments prior to Major Gagarin's epic mission. In fact, on the third occasion, the spacecraft, re-entering along an incorrect descent trajectory, burned up in the atmosphere carrying its two canine passengers, Pchelka and Mushka, to destruction; smaller animals and insects were also aboard.

The third and fourth experiments involving, it is believed, just one orbit and not 18, appear to have been eminently successful and, according to the Russians, Gagarin's flight came next. "There was no earlier attempt," said Academician Nesmeyanov, president of the Soviet Academy of Sciences.

On Entering Orbit

At a Press conference in Moscow on Apr. 15, Major Gagarin addressed a large gathering of correspondents and diplomatic observers, and later answered their written questions.

He said it had been his one ambition to become a pilot, and on his urgent request he was accepted as a candidate for space-training. The night before his orbital mission he had slept soundly and was wakened one hour before take-off.

Within the space-vehicle, he heard the command being given to start the rockets. Acceleration, vibration and noise did not depress him, and he was able to perform all the work that he had to do in accordance with the flight programme.

Once the final stage of the carrier rocket had separated in orbit, Gagarin said he became accustomed to the condition of weightlessness and was able to continue his work. He had become familiar with weightlessness in preliminary tests. (Presumably this was in aircraft flown for short periods on powered parabolic trajectories, so that drag and weight are counter-balanced by centrifugal force.) These conditions, he contended, "do not adversely affect the capacity of an organism to work or its physiological functions."

Gagarin said he ate and drank under weightlessness, and maintained constant radio communication with Earth, using a Morse key and a radio-telephone. He also continued his observations of the environment, taking instrument readings and recording his observations on tape. He even wrote in a notebook.

Concerning his "space-food," Gagarin said he consumed a special jelly-like substance which he was previously trained to eat while weightless. "I squeezed it into my mouth and was able to drink water by the same method."

The interesting point here is that the feeding technique was similar to that employed with the dogs Strelka and Belka in Spacecraft II (Ref. 1). Provided with a glutinous "jelly" containing quantities of nutritious substances and water, the dogs were trained before their orbital mission to take this food from an automatic feeder "in conditions as far as possible simulating those of space-flight."

Re-entry and Landing

All the while he was in orbit, Gagarin said he felt in excellent spirits and was able to perform all the work he had to do. After a certain period, the command was given to descend. The spacecraft was orientated in space, the retro-rocket switched on, and the velocity was reduced to enable the vehicle to come out of orbit. The re-entry proceeded according to programme and the landing was made in the pre-arranged area. Gagarin

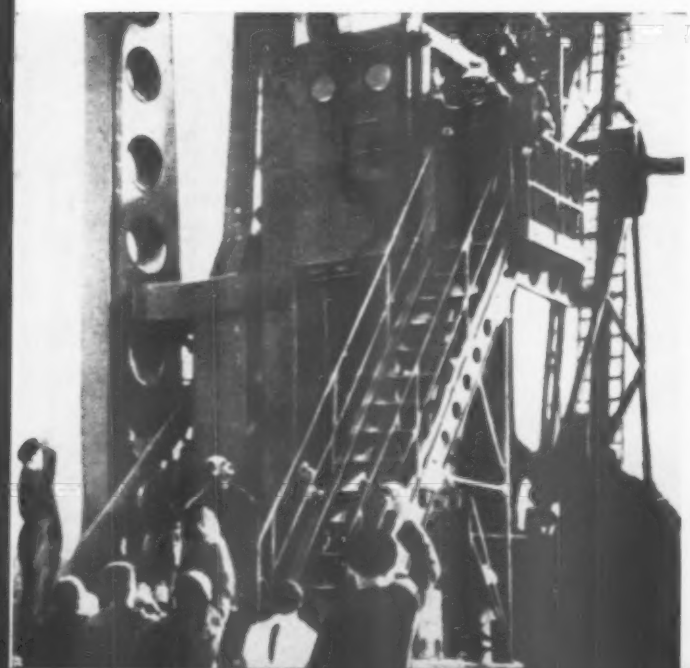
Clad in his space-suit, Major Gagarin is seen in the bus that took him to the launching base prior to the historic orbital flight.

said he was pleased to greet the people "who happened to be there."

The question period which followed the astronaut's statement failed to elicit much technical information. Many techniques for landing have been developed in our country, said Gagarin, one of which is the parachute technique.

"In this flight we employed the following system. The pilot was in the cabin of the spaceship," he began; and then changing the drift of his words, he continued, "the landing proceeded successfully and demonstrated the efficiency of all systems developed for this." That was all. No hint of the re-entry technique or the precise method by which his vehicle had landed.

The landing party appeared almost simultaneously with his arrival, he remarked. His weight before the flight was 69.5 kg., and still about the same. There had been no preliminary flights in ballistic rockets. On the question of visual observation of the ground, he had "looked out through a port-hole;"



Major Gagarin stands at the top of a stairway alongside the first stage of the powerful booster before ascending, by lift, to his "Vostok" spacecraft mounted in the rocket's nose.

SOVIET SPACE PROGRAMME IN BRIEF

VEHICLE	DATE	PAYLOAD	ORBIT	REMARKS
Sputnik I	Oct. 4, 1957	184 lb.	Apogee 588 miles, perigee 142 miles, period 96.2 min.	Carried radio equipment, etc.
*Sputnik II	Nov. 3, 1957	1,120 lb.	Apogee 1,038 miles, perigee 140 miles, period 103.7 min.	Carried the dog "Laika." No attempt at recovery.
Sputnik III	Nov. 15, 1958	2,925 lb.	Apogee 1,167 miles, perigee 135 miles, period 106 min.	Carried wide range of scientific research instruments.
Lunik I	Jan. 2, 1959	796.5 lb.	Aphelion 123.1 m. miles, perihelion 91.2 m. miles (solar orbit), period 443 days.	Passed Moon to orbit Sun.
Lunik II	Sept. 12, 1959	858.4 lb.	Collision course to coincide with Moon. Distance covered 236,875 miles.	Destroyed on impact with Moon.
Lunik III	Oct. 4, 1959	613 lb.	Apogee 298,000 miles, perigee 29,500 miles, period 15 days.	Photographed Moon's hidden face.
*Spacecraft I (Sputnik IV)	May 15, 1960	10,008 lb.	Apogee 228.7 miles, perigee 188.5 miles, period 91.1 min.	Contained "dummy astronaut." Orientation fault in orbit—did not re-enter.
*Spacecraft II (Sputnik V)	Aug. 19, 1960	10,140 lb.	Apogee 211 miles, perigee 190 miles, period 90.72 min.	Successful recovery of dogs "Strelka" and "Belka," etc., during 18th orbit.
*Spacecraft III (Sputnik VI)	Dec. 1, 1960	10,221 lb.	Apogee 165 miles, perigee 117 miles, period 88.6 min.	Carried two dogs "Pchelka" and "Mushka." Burned up on re-entry during 18th orbit.
Sputnik VII	Feb. 4, 1961	14,293 lb.	Apogee 204 miles, perigee 139 miles, period 89.8 min.	Test vehicle for Sputnik VIII?
Sputnik VIII	Feb. 12, 1961	1,419 lb. (Venus probe) That of Sputnik launcher not disclosed.	Aphelion 94.6 million miles, perihelion 66.7 million miles, period 300 days.	Aimed to rendezvous with Venus between May 19–20.
*Spacecraft IV (Sputnik IX)	Mar. 9, 1961	10,360 lb.	Apogee 154 miles, perigee 114 miles, period 88.3 min.	Carried the dog "Chernushka," etc. Successful recovery during first orbit.
*Spacecraft V (Sputnik X)	Mar. 25, 1961	10,350 lb.	Apogee 153 miles, perigee 111 miles, period 88.4 min.	Carried the dog "Zvezdochka," etc. Successful recovery during first orbit.
*Spacecraft VI "Vostok" (Sputnik XI)	Apr. 12, 1961	10,395 lb.	Apogee 187 miles, perigee 109 miles, period 89.1 min. (est.)	Carried first human astronaut. Successful recovery during first orbit.

* Part of Soviet Man-in-Space programme.

there was no television. Would photographs taken during the flight be published? "The spacecraft did not have a single camera and hence there were no pictures to publish."

Asked whether the spaceship could be used again, Gagarin said this matter was best decided by the scientists and engineers, but he personally considered that the entire spaceship and its parts could be launched again. On the question of how many astronauts were in training in the Soviet Union, he replied, amid laughter, that there were enough to perform the assigned tasks. When would another such flight be made? "Our scientists and space-pilots will effect such a flight when it is needed."

When finally Gagarin was asked if the "Vostok" could have carried a man to the Moon(!), he said it could not. "Special spaceships are being created in our country for that purpose."

Thus, the Press conference came to an end, leaving a vast number of technical questions unanswered.

Air-brakes and Parachutes

What precisely are "the many landing techniques" that Gagarin began to describe? If we go back to the early experiments with dogs launched in Soviet geophysical rockets on "up-and-down" trajectories, we find there were two basic recovery methods.

In one, the dogs were carried within the detachable nose-section of a rocket, which was fitted for recovery with a system of extensible petal-like drag-brakes and a parachute (see sectional drawing in THE AEROPLANE AND ASTRONAUTICS, Aug. 12, 1960, p. 185).

In the second, dogs were provided with individual pressure-suits and transparent helmets, enabling them to be catapulted out of the rocket's payload section as it descended into the lower atmosphere. This system was originally described by A. V. Pokrovskii, director of the Institute of Experimental Aviation Medicine, U.S.S.R. Academy of Sciences (Ref. 2).

"Conditions necessary for life and rescue of the animals (two in each rocket) were ensured by means of special space-suits equipped with removable helmets, without oxygen masks, and by means of an ejection chassis equipped with an oxygen supply and a system of parachutes. Special attachments for securing the animals during flight were provided in the space-suit. The ejection chassis was so constructed that the oxygen supply system, the parachute system, and all the equipment for recording physiological functions of flight, could be fastened to it.

The weight of the ejection chassis was given as 70 kg. (154 lb.), the parachute ensuring a vertical landing speed of about 6 metres/sec. The two dogs were accommodated in right- and left-hand ejection chambers in the nose-section of the rocket. Conclusions reached following the experiments were given by Pokrovskii as follows: "The method of ejecting the animals from the rocket compartment at altitudes of 75 to 85 km. (47 to 53 miles) at a speed of about 700 metres/sec. (1,568 m.p.h.), and at altitudes of 35 to 50 km. (22 to 31 miles) at a speed of 1,000 to 1,150 metres/sec. (2,240 to 2,576 m.p.h.) ensures the recovery of the animals, the maintenance of their vital activity, and the absence of substantial changes in their various physiological functions."

Relating this early work of the late 1950s with the information on Spacecraft II given at the beginning of this article, it is tempting to speculate that Gagarin was landed in a similar manner.

The capsule which contained Strelka and Belka was catapulted away from the spacecraft after it had dropped to a height of some 23,000 ft. Twin sets of wheels can be seen at the base of its chassis which presumably run on guide rails in the body of the spacecraft; centrally disposed between them is the ejection device.

At the same time, we have the information that Strelka and Belka could have been recovered within the spacecraft without the capsule separating.

The question has been raised whether the Soviet re-entry vehicles have minimum lifting surfaces to aid their control in the lower atmosphere, before final separation and recovery occurs. Here one can only reiterate a statement contained in an earlier article (Ref. 3). Prof. V. Dobronravov remarked that the use of parachute re-entry methods alone, as was the case in certain Soviet geophysical rockets, will not suffice to return a satellite, "especially one containing a man." "We need a satellite," he said, "which can also be a unique type of glider—one that has devices to prevent the rocket from revolving around its horizontal and vertical axes."

On Apr. 13, the day after Gagarin's flight, the following comment appeared under the name of Igor Merkulov in *Soviet Weekly*. He writes: "It has been found that the best results can be achieved by combining power deceleration with atmospheric drag, where parachutes or wings can be used."

A correspondent in Moscow provides some additional comments by individual Soviet scientists. It is considered by many that human piloting of a lifting vehicle is more effective than completely automatic control monitored from the ground. It is possible to provide the pilot with visual indicators and a screen on which a map is projected to assist in checking the flight co-ordinates. A map of the heavens can be similarly projected. One report describes the pilot as being placed within a capsule which rotates through 360° within the ship to assume an optimum attitude under all conditions of flight.

Sooner or later the facts will be published, but until they are speculation is bound to continue. However, it was done, the spacecraft itself appears to have made a separate descent. And, by any token, it *was* a memorable achievement.

References

1. "Return to Earth" and "Aboard Sputnik V," *Spaceflight*. January, 1961, pp. 9-12.

2. Kreiger, F. J., *Behind the Sputniks*, Public Affairs Press, Washington, D.C.

3. Gatland, K. W., "Soviet Space Boosters," THE AEROPLANE AND ASTRONAUTICS, Oct. 9, 1959, pp. 317-320.

saving TIME
saving MONEY

A 'Widgeon' of British United Airways was successfully used recently, to lay 1,720 ft. of pipeline across marshy ground near Gravesend in Kent. 86 pipe sections, each 20 ft. (6.1 m.) long and weighing 448 lb. (204 kg.), were laid in less than seven hours, and the cost was £200.

If the conventional method of using lorries and a crane had been used to carry out this operation, it has been estimated that it would have taken a week to complete and cost about six times as much.

This is only one of the many ways by which the helicopter can assist the civil engineer in unusual operations and in the saving of time and money.

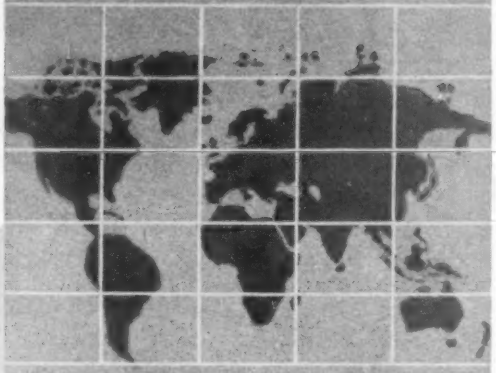
WESTLAND *the great name in* **HELICOPTERS**

WESTLAND AIRCRAFT LIMITED · YEOVIL · ENGLAND

Incorporating: SAUNDERS-ROE DIVISION, BRISTOL HELICOPTER DIVISION AND FAIREY AVIATION DIVISION

Wherever performance counts

the trend is towards 50cm radar for airways surveillance and terminal area control



50 CM

Ensures longer range for given transmitter power.

Penetrates thick weather without loss of efficiency.

Crystal controlled MTI for elimination of permanent clutter.

Provides instant readiness after prolonged shut down.

GIVES THE LONG, CLEAR VIEW

MARCONI

Complete Civil, Military and Naval Radar Systems
Surveyed, Planned, Installed, Maintained

RADAR DIVISION, MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED
CHELMSFORD, ESSEX, ENGLAND

MARCONI 50cm RADAR

has been choosen for

London Airport
Johannesburg
Gatwick
Dunedin (N.Z.)
Geneva
Oberpfaffenhofen
Boscombe Down
Bitteswell
Hong Kong
Manchester
Brussels
Warton
Calcutta
Hatfield
Istres
St. Annes
Birmingham
Rome
Jersey
Bretigny
Wellington (N.Z.)
Ostend
Copenhagen
Ohakea (N.Z.)
and the Royal research establishments at:—
Farnborough
Bedford and
Pershore

Flying the Commander 560F

by

John Fricker

WHEN discussing the sleek Aero Commander, it is important to specify which model one is talking about, since the same basic airframe covers a range of light executive twins varying from the 260-b.h.p./6,250 lb. 500A to the supercharged 380-b.h.p./8,000 lb. 680F. In between, there are the 500B, with two 290-b.h.p. Lycoming engines; the 560F, with two 350-b.h.p. Lycoming IGO-540-B1AS; and the pressurized 680P Alti-Cruiser.

Nearly 1,100 Commanders have now been built since 1952. The popularity of these 5-7-seaters derives largely from the fastest cruise of any aircraft of their class, their ease of handling and the high standard of their finish. From experience with three of the Commander models—including the earlier 520, the new 500B and, most recently, the 560F—these seemed to me among the nicest of the superlative American types to fly although not quite the most expensive.

In 1960, the Commander range, now built by Aero Commander, Inc. at Bethany, Okla., underwent redesign of their engine cowlings to give the slimmest possible contours. At the same time, their nacelles were extended aft to give a flat aerofoil shape. To accommodate the main undercarriage legs within the 9-in. shallower nacelles, which were also raised more than 4 in. on the wing, the mainwheels were arranged to turn through 90° during retraction and to lie flat.

Low-drag cooling also replaced the original exhaust augmentor system, with a reduction of intake area, and exhaust ports in the low-pressure region above each nacelle. Electrically operated cowl flaps vary the flow of cooling air, cylinder-head temperature gauges being provided in the cockpit.

Nacelle redesign improved the Commander's lift/drag ratio from 12 : 1 to about 16 : 1, with an overall drag decrease of about 10%, and an addition of some 400 lb. of lift from each nacelle. This almost balanced the weight of the IGO-540 Lycomings, while the increase in effective wing area reduced the stall by 5-6 m.p.h. as well as improving all-round performance.

The raised and slimmer engine nacelles also improved cabin visibility, while the larger airscrew tip clearances from the fuselage resulted in a further decrease in noise. With its high wing and low-slung fuselage, the Commander conforms closely to the optimum layout for an executive aeroplane, as no steps are needed for access to its cabin, and the door for the 32 cu. ft. baggage compartment is equally close to the ground.

On entering G-ARDK, the newly arrived Commander 560F demonstrator of Field Aircraft Services, Ltd. (the U.K. sales agents) at Stapleford last week, I noticed that the main door was rather close to the port Hartzell three-bladed airscrew. This is perhaps the only penalty of a layout which provides remarkably generous accommodation for so compact an aeroplane. Against neighbouring Herons, Doves, etc., in the Field maintenance area at London Airport, the Commander was earlier seen to be a small aircraft, despite universal provision for the full seven seats.

The cabin is wide rather than high, which permits a bench seat for three against the rear bulkhead. There is then room for an aisle between the two pairs of forward places. All seats are quickly removable for freighting.

As one would expect from an aeroplane with a delivered U.K. basic price of around £42,500, the 560F has a very high standard of appointments, including individual ventilators and reading lights, flush-mounted ash-trays, reclining seat backs, and attractive carpeting and upholstery. Seating layouts are, of course, variable, and for long-range operations the rear bench can be replaced by a toilet compartment.

With its grey-painted panel and "buried" radio controls, the cockpit layout has a functional efficiency approaching the clinical, but which I found pleasant. The flight instruments, on the left, and central engine references, have Grimes "eyebrow" lighting for night operation. Landing and taxi-ing lights are located in the nose, on each side of the nosewheel well.

Radio in the demonstrator comprised duplicated Bendix RA-21A and TA-21A receivers and transmitters, for VHF navigation and communications, coupled with a VOR/ILS cross-pointer and an ARC-21A ADF. Selectors and mixer switches are above the instrument panel.

Pilots and forward passengers have an excellent view, restricted only slightly by the windscreen side frame and the D.V. panel inlet. Power, flap and undercarriage controls on the central pedestal come nicely to hand, as do the logically operated elevator and rudder trim wheels, once they are tracked down in the roof panel.

Having coaxed the Lycomings into life, from the right-hand seat via the spring-loaded ignition/starter rotary switches, Field Aircraft Services pilot Ken Burville, who had ferried 'DK across the Atlantic, leant across to release the parking brake plunger for me to taxi out. Two 87-Imp.-gal. ferry tanks had

Photographs copyright "The Aeroplane and Astronautics"

A neat and functional cockpit is a feature of the Commander 560F, which is fitted with full dual control. Radio switches and selectors are at the top of the panel; ADF is at the bottom of the central pedestal.

been carried in the fuselage to supplement the normal 185-Imp.-gal. wing tankage of the 560F for the delivery flight, which was across the N. Atlantic route.

The Commander is unusual in having a very simple fuel system, which in the 560F has a single selector for each group of wing tanks, with no cross-feed. The lower-powered Commanders have no outer wing tanks, which are of 28 Imp. gal. capacity each side, and make use of a common centre tank for supply to both engines.

With the fuel-injected Lycomings in the 560F, initial movement of the throttle levers results in fairly large variations of power. A unique feature of the Commander is the system of nosewheel steering, which instead of operating as usual directly from rudder pedal movement, depends on hydraulic actuation from initial pressure on the toe brakes.

This gives sensitive and precise control for steering on paved surfaces, but, on rough grass, I found it difficult to judge the amount of pressure needed to steer the nosewheel without applying the powerful mainwheel brakes and thus over-controlling. With its extreme forward-set nosewheel and long wheelbase, however, the Commander seemed remarkably stable on uneven turf, and its undercarriage proved unexpectedly soft to iron out the worst of the bumps.

Before take-off, we lowered one-quarter flap (10°), on the gauge, with the infinitely variable selector lever, checked trim, and opened the cowl flaps half-way. Mixture controls were pushed forward to fully rich, a fuel flowmeter, graduated in lb./hr., being included among the engine instruments.

After opening up to full throttle and 3,400 r.p.m. on the brakes, acceleration with only two people on board and less than a full fuel load was decidedly brisk. I again found slight difficulty in avoiding brake application when trying to steer the nosewheel before the rudder became effective on take-off. The trick seems to be to know when to drop your feet from the toe pedals to the floor, to get rudder without brake. Even so, we did not use a great deal of Stapleford's 800-yd. E-W strip before slight aft wheel pressure resulted in an unstick at about 70 knots.

Vmc of the Commander 560F is 78 knots, and acceleration to the best single-engined climb speed of 91 knots is very rapid. It is assisted by the swift undercarriage retraction, which takes 3.5 seconds, and is accompanied by a slight nose-up trim change. Flap operation is usefully slower, and results in little sink or trim effect from small settings. For the maximum climb, 104 knots recorded nearly 2,000 ft./min. at our relatively light weight, and a more comfortable angle at still well over 1,000 ft./min. is achieved at about 120 knots.

Max. continuous power of full throttle and 3,000 r.p.m. for the climb gives a fuel flow of about 150 lb./hr., which can be reduced at the secondary climb setting of 2,800 r.p.m. Best cruising altitude of the 560F is about 10,000 ft., but during my flight I settled for about 3,400 ft., where 22 in. Hg. and 2,600 r.p.m. resulted in an indicated 165 knots or so.

At this 60% power setting, the fuel flow could be varied between 100 lb./hr. for power or 82 lb./hr. for economy. At 10,000 ft. it is possible to cruise at more than 200 knots at 70% power, but the optimum range, with 30 min. reserve, of 1,500 miles is achieved at 55% power, and a T.A.S. of 180 knots (207 m.p.h.). Consumption is then 23.7 gal./hr.

From the handling point of view, the extra power and weight of the 560F, compared with earlier Commanders I had flown, was reflected in its slightly heavier control loads and out of trim forces. These were never particularly great, and control harmonization was good. The rudder seemed heaviest of the controls, with the elevators next and the ailerons lightest, which is as it should be.

Allied with good all-round stability, these characteristics add up to an aeroplane which is easy and very pleasant to fly. Maximum positive load factor of the Commander is 3.47 *g* which is about normal for its class, and its never-exceed speed is a comfortable 250 knots.

Noise level is low, although some buzz from the airscrew tips is evident. The absence of vibration also results in a very smooth ride, and only on opening the cowl flaps in some conditions of high power and temperatures is some buffet evident on the tailplane. The trim wheels are high-geared, sensitive and positive, enabling the Commander to be trimmed out precisely, which is a useful consideration when flying airways with a single crew member and without the optional Sperry SP-3 autopilot installed.

At 3,500 ft. over the flat fields of Essex, I throttled back to try out the low-speed performance of the Commander. At minimum power, there is a pronounced braking effect as the constant-speed airscrews fine-off in an attempt to maintain the selected r.p.m., resulting in a potent deceleration. No great difficulty was encountered in holding the nose up as speed fell off, until to the blare of the undercarriage horn was added the peep of the stall warning device, starting at about 80 knots.

Clean, the Commander stalled gently after a slight buffet, at about 70 knots I.A.S., dropping quite straight unless aft pressure was maintained on the wheel, in which case a wing-down tendency becomes apparent. Some lateral control remains throughout, however, and height loss is only about 300 ft.

Full lightweight de-icing equipment is visible on the low-slung Aero Commander 560F, which, with its forward-set nosewheel, has a long undercarriage base for good ground stability.

With gear and half-flap down, below their respective limit speeds of 156 and 130 knots, and a little nose-up trim to maintain a representative circuit speed of about 100 knots, a straight stall again resulted, at about 65 knots, I.A.S. The Commander seems resistant to *g*-stalling at low airspeeds, although elevator sensitivity remains good throughout.

From the approach configuration, trimmed to a representative 85 knots, a simulated overshoot at full power resulted in a remarkably small nose-up trim change at our forward C.G. Directional trim changes were more pronounced, a fair amount of right rudder being needed with the increase in power.

When Ken Burville cut the starboard engine on me in cruising flight, I found the foot loads to keep straight moderate until the airscrew had feathered, when they decreased to a very low value. A quick twist of the rudder trim wheel brought the ball of the turn and slip back to the centre, and a little aileron kept the wings level. With 24 in. Hg. and 3,900 r.p.m. on the port Lycoming, the Commander cruised along quite happily at 125 knots, and turns in each direction presented no difficulty.

With max. continuous power of full throttle and 3,000 r.p.m. on the live engine, and the nose raised to 100 knots, the V.S.I. crept up to indicate more than 500 ft./min. ascent. The Commander range are among the best in their class for single-engine performance, and the 560F has a ceiling on one motor of 9,800 ft.

For landing, full flap of 40° may be lowered below 118 knots, with a nose-down trim change requiring a further touch of forward trim wheel movement after undercarriage extension. The Commander trims comfortably into its recommended 85 knots final speed, at which view, control response and attitude are generally pleasant. As the pilot is so near the ground—he sits little higher than in the average motorcar—I found a slight tendency to flare out on the high side, but the Commander is one of the easiest aircraft to land I have encountered.

At 85 knots and our light weight, some float was evident, and with experience it would obviously be possible to reduce the figure. Continued elevator response makes it possible to lower the Commander on to a runway as gently as a crate of eggs, and the nosewheel can be held off for aerodynamic braking. At Stapleford, it was a question of getting it on the ground and stepping on the brakes, but the 560F pulled up in about 400 yd. from touch-down.

The Commander undoubtedly proved its practicability for rough-field operation and this adaptability is one of its many virtues. Fitted with Goodrich lightweight de-icing boots on wings and tail, plus rubber shoes on the airscrew leading-edges, it is an all-weather aeroplane, and is used as such on important schedules by many executive operators in the U.S., Europe and now Britain.

Leading Particulars

Dimensions.—Span, 49 ft. 6 in.; length, 35 ft. 1.25 in.; height, 14 ft. 6 in.; gross wing area, 255 sq. ft.

Weights.—Empty (dry, plus 30 lb. for residual fluids), 4,650 lb.; useful load, 2,850 lb.; max. gross, 7,500 lb.

Performance.—Max. speed, 248 m.p.h.; cruising speed, 70% power, 10,000 ft., 232 m.p.h.; initial climb, 1,720 ft./min.; single-engine climb, 490 ft./min.; service ceiling, 21,900 ft.; single-engine ceiling, 9,800 ft.; stalling speed, gear and flaps down, 73 m.p.h.; take-off distance to 50 ft., 1,250 ft.; landing distance from 50 ft., 1,375 ft.; range, at 55% power, 30 min. reserve, 1,500 miles.

Personal Flying

MID-AIR collisions in the U.S. involving general aviation aircraft almost doubled during 1960, compared with 1959, according to a recent report by the F.A.A. One of the most significant findings of the report was that most collisions occurred within the circuit or local flying areas of airports and involved aircraft of similar size and speed. Although a large number of American light aircraft have radio, the operation of control towers has reduced but not eliminated the occurrence of collisions within control zones.

Twenty-four collisions involving light aircraft are reported by the F.A.A. during 1960, and only six involved large commercial or military machines. A futher six resulted from prearranged formation flights or sporting events involving flight in close proximity, including closed-circuit racing. Of the 48 aircraft in collision, more than half (26) were high-wing types, but this, of course, reflects the preponderance of light aeroplanes currently in U.S. production.

Although the F.A.A. acknowledges that the number of general aviation aircraft and hours flown substantially increased in the period under review, they consider that this increase by no means explains the larger number of collision accidents. On the other hand, considering the number of aircraft within the U.S. "general aviation" category—usually quoted as about 70,000—the percentage of collision accidents is remarkably small.

• • •

Three executive operators in Peterborough—Baker Perkins, Ltd., Mitchell Engineering and Mitchell Construction—have pooled resources for joint operation of their aircraft under a new company, Peterborough and Spalding Aviation. Each company has had its own aircraft for some time, and the new organization will provide pilots and operations and maintenance staff for them. It will also offer its services as consultants to other local firms or organizations wishing to acquire or operate aircraft.

The new company has taken over Spalding Airways, which was formerly responsible for the servicing of the Mitchell and Baker Perkins aircraft, from Mr. George Clifton. He becomes managing director of Peterborough and Spalding Aviation, whose directors also include Mr. Roy Mitchell, Mr. Ivor Baker and Mr. D. Morell. Mitchell Engineering has had its own executive aircraft since 1948, and currently operates a D.H. Dove. Baker Perkins and Mitchell Construction both bought Piper Aztecs at the end of last year.

• • •

The Berck "rassemblement" over the Easter week-end was an unqualified success, despite variable weather and the usual layer of low stratus along the N.W. stretch of French coast. This had a base of only 500 ft. or so, but since Berck is on the coast, just below Le Touquet, it was possible to fly below it over the sea.

About 40 aircraft arrived from Britain during the week-end, and their occupants received a warm welcome from the French aero-club representatives. One of the strongest contingents came from the Herts and Essex Aero Club at Stapleford, which contributed a Caribbean, two Aircoupes, two Messengers, a Hornet Moth, a Prentice and sundry other types. It is possible that a return rally will be arranged by the Stapleford members.

• • •

Another French rally has been announced by the Aero-Club de Vichy, which is holding its second "rassemblement" and fair for business aircraft over the week-end of Jne. 24-25. The programme includes a display of new and second-hand aircraft for sale, competitive events, official receptions and banquet, and presentation of awards.

Entrance fees are 20 NF per aircraft, plus 75 or 100 NF for accommodation, etc., according to whether it is desired to stay until Sunday or Monday, Jne. 25 or 26.

• • •

Rough weather marred the flying week-end held by the McAully Flying Group at Little Snoring on March 25-26, and it proved impossible to hold the aerobatic competition for the Elwyn McAully Trophy. Quite a few aircraft turned up for the week-end, however, including a privately operated ex-U.S. Army Beaver from a U.S.A.F. flying club, and the Aircoupe, Aero 145, Mousquetaire and Colt demonstrators.

Gliding Notes

by Dr. A. E. Slater

PAUL BIKLE'S surprising new altitude record of 46,267 ft. in California was indeed carried out without pressurized clothing, for he writes confirming this, though he admits to considerable experience of high-altitude flying in Service aeroplanes. He did not deliberately exceed the 45,000 ft. usually accepted as the unpressurized physiological limit, but his altimeter must have been reading low because, as soon as it showed 45,000 ft., he put out the brakes and made for the downgoing side of the wave. It is dangerous to linger at such heights.

Previous wave flights to more than 40,000 ft. have been made in the lee of the main range of the Sierra Nevadas, which have many peaks exceeding 13,000 ft., culminating in Mt. Whitney's 14,495 ft., and are bounded on the east by a continuous escarpment about 70 or 80 miles long. In reply to my question whether he was towed into this region, Paul Bikle says he was well south of it, and flew in the lee of a southward extension of the Sierra Nevada range where the mountains average only 6,000 to 7,000 ft. and are broken up by many valleys and canyons. But two years ago another pilot, Dewey Mancuso, reached 37,000 ft. in the same region.

The mountain range here runs N.N.E. to S.S.W., so the W.N.W. wind blew at right-angles to it. But, oddly enough, the main wave cloud, which he outclimbed, lay from S.W. by W. to N.E. by E., with its axis at about 30° to the range. It was a huge cloud, 15 to 20 miles wide, and its leading edge lay as much as 25 miles to leeward of the highest peaks.

As to the extraordinarily low height to which he sank before climbing, enabling him to beat the World's gain-of-height record by 6,500 ft., Paul Bikle says that he made for a band of dust rising from the ground, similar to that sometimes seen in the Owens Valley to the north where previous records have been flown. But although the lift in this dust was definitely associated with the wave, he is not sure that it should be described as wave lift.

His oxygen equipment was a low-pressure system using a pressure demand mask and regulator, such as was used in many previous Sierra wave flights, including World altitude records by Betsy Woodward (39,994 ft. feminine record), "Bill" Ivans (42,100 ft. single-seater) and Larry Edgar and Harold Klieforth (44,255 ft. two-seater).

The three previous gain-of-height records were: Karl Bauer in Germany, 31,709 ft.; "Dick" Georgeson in New Zealand, 34,000 ft.; and S. Jozefczak in Poland, 35,760 ft. Yet at least two leading New Zealand newspapers, announcing Jozefczak's record, said that he beat Bauer, and ignored Georgeson completely. Such is national pride.

• • •

ELLIOTTS of Newbury's third prototype of the 15-metre Olympia 460 was first flown by David Ince at the R.A.F. Bicester meeting just before Easter, and later took part in comparative trials with the other two, which were also there. The breakaway of airflow behind the hood, which upset the performance of the first two, has now been cured, and No. 1 prototype's hood has been brought into line with No. 3.

All three will be flown in the National Championships next month, and if they show up as well as expected, Elliotts may produce a 19-metre version of the type, suitable for the Open Class in World Championships.

A Slingsby Skylark 3F being assembled at Lasham.

Industry Record

For Photographic Reconnaissance

A wide-angle camera which, it is claimed, will enable the exact location of any military objective to be identified on a large-scale tactical reconnaissance photograph, is announced by Fairey Air Surveys, Ltd. Known as the Fairey Monitor camera, it has a lens angle of 186° giving small-scale cover of the area from horizon to horizon.

The lens was originally developed by the Australian Weapons Research Establishment at Woomera, in co-operation with the Fairey Aviation Co., of Australasia Pty., Ltd. Mounted in target aircraft it was designed to give a photographic record of guided weapon interception.

The camera's electrical circuit is compatible with the R.A.F.'s standard Vinten F.95 low-level reconnaissance camera. Running in parallel at three or six frames per second the centre of the Monitor camera picture approximately coincides with that of the F.95.

One feature of interest is an event marker. When specially signalled by the pilot a small neon bulb built into the camera body records a mark on the edge of the film. Frames bearing such a mark can then be easily selected for special examination as soon as the film is developed.

Dimensions of the camera are: 6 in. x 5½ in. x 3¼ in. Its weight is 7½ lb.

Test Rig From Bristol

Something new from Aircraft Ground Equipment, Ltd., is a testing rig for oleo legs and hydraulic jacks. This is a fabricated hydraulic press which incorporates a number of new ideas enabling the operator to perform compression tests on aircraft jacks. It can accept these and oleos up to 10 ft. 5 in. in length and, say its makers, produce constant test loads in excess of 175 tons over long periods. To ensure this and to prevent the ram table from falling, should a hydraulic or power failure occur, the table can be locked into position as the compression load is applied.

Both the ram table and a crosshead adjuster are hydraulically controlled from the supply unit and a gauge directly calibrated in tons gives accurate indication of applied load. The rig can be modified to give different outputs and to suit individual requirements.

VC 10 Fuel Tank Sealing

A specially designed wing-rotating unit or torque box manipulator has recently come into operation at the Weybridge factory of Vickers-Armstrongs (Aircraft), Ltd. It is used during the sealing process of VC 10 fuel tanks. Designed by Matterson, Ltd., of Rochdale, and built in association with Yates Plant, it cost approximately £18,000.

Basically the manipulator consists of two steel rings, 18 ft. in diameter, assembled vertically and in parallel, on rollers sunk into the floor of the sealing shop. The wing centre section containing the fuel tank is clamped between the two rings, parallel with the floor, so that in effect it forms the centre of a rotating cradle.

The driving units are an adaptation of the standard heavy-duty rotators made by Yates Plant for welding manipulators. This company has been responsible for the main structure of the rig. Hydraulic motors are used for ease of control and make flameproof electric gear unnecessary.

After tests for leakages, liquid Neoprene rubber is pumped into the tanks and the whole unit is rotated so that the entire inner surface of the tank is coated. When rotation is finished—three revolutions take about six minutes—the tank is emptied, leaving a fine film to coat and seal the lining. A total of 2,600 gal. of rubber are pumped into the tanks and the weight of the centre section, when loaded in this way, is 10-11 tons.

Sealing of the Vanguard's integral fuel tanks was also done by rotating the entire outboard section of the wing. In this case, however, the section could be balanced on engine and undercarriage mountings and swung over vertically by grabs descending from an overhead gantry.

Engine Agency

Responsibility for all Bristol Siddeley Engines, Ltd., interests in the West German Federal Republic has been taken over by Powell and Co., A.G., of Kapellenstrasse, 1, Bad Godesberg. The previous agents were Luftfahrt Technik G.m.b.H. of Dusseldorf.

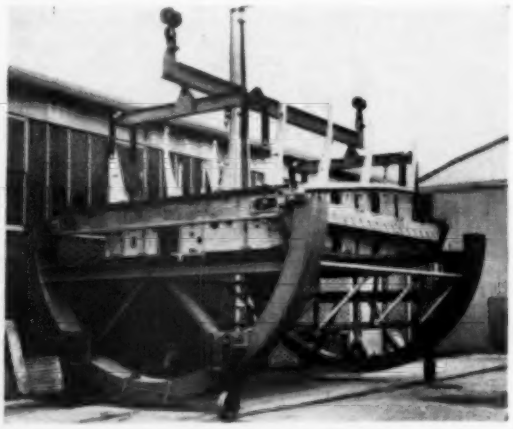
Miniature Integrating Gyro

Inertial navigation and guidance for missiles and aircraft are among the applications of a new miniature integrating gyro now available in the U.K. through Ketay, Ltd. Known as the Type RI-203, it is a product of the Norden division of the United Aircraft Corpn. It is used, in conjunction with Norden single-axis accelerometers, in the miniature all-attitude inertial platform recently shown in this country.

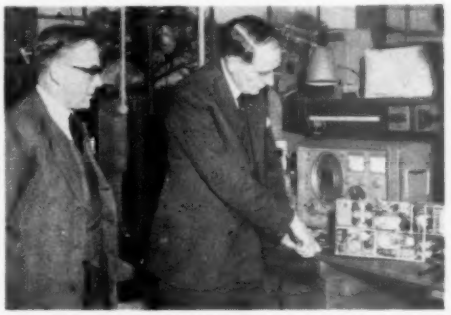
Claims for the gyro include a random drift rate of less than 0.02 deg./hr., day-to-day stability of 0.10 deg./hr. without trimming, and a life of 3,000 hr. The low drift has been achieved with a spin motor turning at only 12,000 r.p.m.—a speed which contributes substantially to the unit's long life. With a length of 3.1 in. and a diameter of 2 in., the gyro, including heater and shields, weighs 1 lb.

Benelux Sales

Flexibox, Ltd., of Manchester, makers of mechanical seals for aircraft fuel pumps, has formed with its Dutch agents a new company, Flexibox N.V. Operating from the Hague this company will handle sales matters in the Benelux countries.



A wing section is lowered into the bottom half of the Matterson wing-rotating unit.



Dr. J. S. McPetrie, Director-general of Electronics Research and Development, M.o.A., examines the new Sixty Series transistorized VHF transmitter during a recent visit to Marconi's aeronautical division. On the left is Dr. B. J. O'Kane, division manager.

Automatic Seat Reservation

At a cost of £325,000 B.O.A.C. is to adopt an electronic seat-reservation system to be supplied and installed by Standard Telephones and Cables, Ltd. The purpose is to provide ticket-selling offices throughout the U.K. and Europe with up-to-the-minute information on the availability of seats on all the Corporation's flights and those of its associates. In each case this will be available over a period of up to 20 weeks ahead of the flight date.

The first part of the system comes into operation towards the end of this year when a central magnetic drum store of flight information in the Airways Terminal, Buckingham Palace Road, will serve about 100 sales personnel using special keying sets within the terminal building itself. Later, using telegraph circuits, the system will be extended to various points in London including London (Heathrow) Airport. Further extensions are planned to the larger centres in the U.K. and eventually to a number of European cities.

In designing this system Standard Telephones have concentrated on using well-tried components and assembly techniques together with transmission speeds and error-checking correction facilities on practical communications networks which are available at low cost from the postal authorities over whose territories the communications are linked.

B.E.A. are exploring the possibilities of using a similar system and one is already in use with S.A.S. This was supplied by Standard Elektrick Lorenz A.G. A photograph of a reservation clerk's keyset appeared on page 85 of our Jan. 27 issue.

Metals Division

Dewrance and Co., Ltd., has formed a metals division with a foundry at Hillington and a special alloys division in London. This will have its own board of management and will be responsible for the production and sales of non-ferrous, nickel, alloy and stainless steel castings, hardfacing and high temperature brazing alloys.

Production executive for this new division is Mr. J. B. Morton, who will be based at Hillington. Mr. E. Wallace, the sales and technical executive, is situated in London.

A Record Year

Sales of portable compressors manufactured by the British and Belgian member companies of the Atlas Copco Group did much to make 1960 a record year for the group whose total revenue was £33,100,000. This represents an increase of £6,900,000 over 1959. Air compressors, drills, engineers' tools, paint spraying equipment and other pneumatic apparatus are the principal products of the group which comprises a parent company in Stockholm and subsidiaries in 28 countries. Disposable profit according to the consolidated balance sheet was £3,760,000 for last year.

Correspondence

Powerplant Plurality

AIRCRAFT owners, and other readers who have enjoyed the benefit of hire-purchase facilities, may well be amused by the apparent generosity of a leading Hire Purchase Bank.

On being advised by us that a Beechcraft Bonanza, which we had sold to a client requiring Hire Purchase finance, had a CONTINENTAL E.225-8 ENGINE, we were somewhat taken aback to read the Hire-purchase Agreement appropriate entry as: "Engines No(s.): 1. E.225 2. E.226 3. E.227 4. 228."

Several interesting thoughts arise; could the Hirer sue for non-delivery of part of the goods? Even more interesting would be Beechcraft Corporation's reaction to the suggestion that their aircraft need one engine per passenger.

P. J. PHILLIPS, Aviation Manager.
London, S.W.1. R. K. Dundas, Ltd.

A Flying-boat Reunion

I WAS most interested to see your article on the successful conclusion of Mr. Thomas's campaign to preserve a Sunderland. I only wish that the date of its arrival at Pembroke Dock had been publicized in advance for there would have been many like myself who, once having flown that wonderful aircraft, would have made the pilgrimage to see one flying boat for the last time.

I myself was a member of 201 Squadron at Pembroke Dock when, with 230 Squadron (the last flying-boat squadrons in the U.K.) they were disbanded in January, 1957, and I had the pleasure of flying one to Seletar to join 205-209 Squadron, as it was then, until the Sunderland finally retired in May, 1959.

I have in my possession the control wheel and fog bell of RN.303, suitably inscribed, which was the last but one aircraft by only a few hours.

I was puzzled to note your remarks on the fixed guns being fitted in the leading edge of the main planes. This is a modification that is news to me and your writer is, I think, getting confused with the 4 x 303 fixed guns in the hull, fitted around the front gunner's legs, and fired by the pilot aiming with a fixed ring and bead sight.

Incidentally, there was a reunion last year of the Far East Flying-boat Wing, but I have not as yet heard of any plans to repeat the occasion this year, and would be most interested to know if there are any plans afoot. Also, I have been approached by several ex-flying-boat personnel to investigate the chances of organizing a reunion of ex-Pembroke Dock flying-boat crews, and would be prepared to organize such a function, to include perhaps all flying-boat crews. Depending, of course, upon the response, which might be quite enormous, it could be held in London, or, better still, at Pembroke Dock itself—a most appropriate venue.

Those interested might contact me at: Tampines, Phygtle, Chalfont St. Peter, Bucks. W. R. FOSTER.

[We were not thinking of the modification referred to by the writer who will find, we believe, that the wing installation was developed as a unit, rather than as a manufacturer's, modification.—ED.]

Man in Orbit

NOW that the justifiable acclamations about Russia's man-in-orbit are dying down, it might be permissible to sow just the tiniest seed of possible doubt.

There is no question at all that Russia was capable of putting a manned capsule into orbit and of recovering it safely, and there is little doubt that the thing has actually been done—but was it done at the time and even on the day given by the Russians?

The whole publicity operation—including a news announcement apparently made before final success had actually been achieved—was entirely out of character for this mighty bureaucracy, which is in the habit of offering "news" days and even weeks after the actual events. Nor does the timetable of the "flight" make sense. With a launching at 07.07 hrs. B.S.T., the capsule just could not have been "over South America" at 07.22.

Maj. Gagarin was a brave and lucky man—even on the showings of admitted previous failures and successes. A capsule launched on May 15, 1960, with a dummy man aboard, was burnt up; a second, carrying two dogs and launched on Aug. 19, was brought back according to plan; a third one, launched on Dec. 1 with two dogs, was a failure; and a fourth, on Mar. 9, 1961, was a success.

London, S.W.3. A. H. HENDERSON.

The Vertijet First

THERE appears to be an error in the phrasing of the award to Mr. Tom Brooke-Smith for his work with the SC-1 (THE AEROPLANE AND ASTRONAUTICS, Jan. 13, page 32). Shouldn't "in the World" be amended to read "in England" or "in Europe"?

The first public demonstration in the World of both vertical take-off and landing, by means of direct lift, and transitions between hovering flight and winged flight was given by Pete

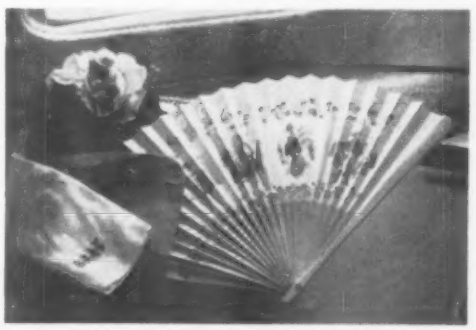
Groundabout

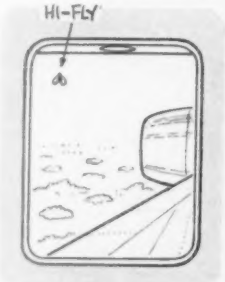
From Our Man In Peru

Following the Apr. 6 article headed "Peruving Flight to Lima," normal service will now be resumed.

Your private opinion of this columnist's activities was probably confirmed by the Lima paper's description of me as a "*periodistas especializados en cronicas de aviacon*"—that is, a periodical specialist in chronic aviation. Oh, well. The same paper revealed the ardours of this kind of tour. After a local demonstration flight in B.O.A.C.'s "Rolls-Royce 707" the Peruvian pressman's chief recollection was that during the hour's trip 50 bottles of whisky, champagne and cognac were consumed. What, no gin and *lima?*

While waiting to take off from tropical Trinidad, the stewardess gave us, for our fevered brows, small towels soaked in eau-de-cologne—delicious! Then we each got a fan—me with a *fan?* (Thinks: So this 707 is equipped with thermo-fans—quickly unthinks). Finally, we were given a *rose* apiece. I say, chaps, steady. B.O.A.C. Take Good Care Of You. And here's pictorial proof.





During the Lima-Trinidad flight Capt. Frank Taylor tried his limited Spanish on one of the South American countries, identifying his airliner as a "Siete-O-Siete," but vainly. Only when he tried "*Boeing* Siete-O-Siete" did he get through to the gent 40,000 ft. below—"Ah, *BOING!* Si!" So, to Gordy Williams' publicity boys at the Boing Aeroplane Co.—*Olé!*

In the City of Kings, I'd met a man who really rates for mention in a journal called THE AEROPLANE AND ASTRONAUTICS. Name of Ian Rokes, he was, pre-War, a bank manager in Peru; came '39 he joined the R.A.F., became a radar specialist in N. Africa, returned to Peru when peace broke out. There at Iquitos in the interior he established a centre for collecting tropical fish and fauna for supplying to an eager American market. The business so prospered that he's turned from chartering aircraft, in which to carry his exotic freight, to the do-it-yourself system. He runs his own airline called AVASA (Aerovias Amazonas S.A.) with two Curtiss Commandos. The astronautics side? He supplies the monkeys which the Americans shoot into space.

by Gordon

Girard in a U.S.A.F. X-13 Ryan Vertijet at a public air show at Andrews Air Force Base, July, 1957.

On Jly. 30, 1957, at 10.02 a.m. in front of 3,000 invited guests, including the military attachés of the Embassy staffs in Washington, D.C., the demonstration was repeated from the River Entrance of the Pentagon. This occasion was the 48th anniversary of the final acceptance flight of the World's first military airplane, the Wright Flyer.

The Wright machine took off from Fort Meyer, Virginia, flew around Shuter's Hill in Alexandria, Virginia, now the site of the National Masonic Memorial Tower, and returned, a course measured by the U.S. Army Engineers in order to establish the contract speed capability of the machine. The Vertijet flew this same course starting two minutes behind the scheduled take-off time.

Since the Vertijet is a tail sitter, there can be no doubt that it took off and landed " by means of direct lift."

Imperial Airways' own Major George Woods-Humphery, was my guest. He described the occasion as the greatest event that he had witnessed in his 40 years in aviation.

Georgetown, Delaware. W. P. MAIERSPERGER
(Lt.-Col. U.S.A.F., retd.)
Staff Engineer, All American Engineering Co.

Fact and Fiction

TWO books* that have recently reached us deal with widely different facets of aviation in widely different ways. One is fact; the other is fiction. And each in its individual way makes exceedingly good reading.

" FATE IS THE HUNTER " is a fascinating collection of reminiscences by an airline pilot covering something like 11,000 hours in the air. In fact Ernest Gann's book tells some of the inside story of the development of airline flying—as seen from the flight deck—in America, from the early 'thirties to the late 'forties with an interlude of wartime ferrying. So vivid is his writing and so good the generation of " atmosphere " that the reader is always present on the flight deck to share with the crew their moments of excitement and of boredom, their problems and their fears.

There are, indeed, occasions where one subconsciously breathes a sigh of relief at being back on the ground again after some particularly difficult trip (such as a scheduled service in a DC.3 in freezing rain and nil visibility and rapidly disappearing fuel). This book is one of the most enthralling narratives of the air routes to date and once started is hard to put down.

In " THE CAULDRONS OF THE STORM " one finds a nice piece of aeronautical fiction and another book that is hard to put down. It is written around the delivery of some ex-wartime Wessex-Wasp twin-engined fighter/bombers to Teruba, a small revolution-torn South American state.

The central character " Peachy "—ex-Squadron Leader and Battle of Britain veteran, C.F.I. of the local flying club, determinedly preserving his wartime slang and fighter moustache—is one of those splendid types one occasionally finds refusing to grow up. Because of this, he may irritate at first, but as the story proceeds he tends to grow on one as a kindly and ever-youthful person finding the postwar world on the ground a little tiresome and frustrating, and never really happy unless he is flying.

Peachy's adventures during the long and hazardous ferry flight in company with an assortment of other characters—pleasant and otherwise—make entertaining reading. Indeed, it is to be hoped that the author might find some more high adventures for Peachy before the gallant chap becomes too old for active flying. He is just the sort of character who might find a lot of fans among the fiction readers.—F.T.M.

* **" Fate is the Hunter "** by Ernest Gann. Published by Hodder and Stoughton. Price 21s.

" The Cauldrons of the Storm " by W. D. Pereira. Published by Robert Hale, Ltd. Price 12s. 6d.

PUBLICATIONS RECEIVED

Sir George Cayley by J. Laurence Pritchard. Described in a foreword by Peter Masefield as " one of the half-dozen most important books on aviation history yet written," this volume is the first to accord proper recognition to Sir George Cayley as " the inventor of the aeroplane." Cayley succeeded in launching man-carrying gliders in 1849 and 1852-3; in this biography, Capt. Pritchard produces a wealth of new information about his aeronautical research and his other wide interests. 278 pp. 5½ in. by 8½ in. Illustrated. Max Parrish and Co., Ltd., 42s.

The Conquest of Space by Albert Ducrocq. Translated from the French text first published in 1959, by a well-known scientist and author, this is an examination of the work being done in the U.S. and Russia to conquer space, and a forecast of future developments and their likely time-scale. 300 pp., 5½ in. by 8½ in. Illustrated. Putnam and Co., Ltd., 30s.

1961 Aviation Directory of Canada. Compiled by the editor of *Aircraft*, this valued directory follows its established pattern, with sections covering: the aircraft industry; the air transport industry; military aviation; Government departments and organizations; and Who's Who. 164 pp. 8 in. by 11 in. Farm Equipment Publishing Co., Ltd., $7.

Aviation Calendar

Apr. 20

London.—R.Ae.S. All Day Symposium on " Air Traffic Control," in the Lecture Theatre, 4 Hamilton Place, W.1, at 09.45 hrs.

London Airport.—R.Ae.S. L.A.P. Branch lecture, " Space Travel," by A. V. Cleaver, in the Senior Mess, B.O.A.C. H.Q., at 18.00 hrs.

Apr. 21

Hatfield.—R.Ae.S. Branch Annual Dinner, in the de Havilland Restaurant, at 18.15 hrs.

Apr. 25

London.—R.Ae.S. lecture, " The Origin, Structure and Growth of Vortex Separations," by E. C. Maskell, in the Lecture Theatre, 4 Hamilton Place, W.1, at 19.00 hrs.

Apr. 26

London.—R.A.F. Sixth Anniversary Concert, at the Royal Festival Hall, at 20.00 hrs.

Apr. 28

Coventry Airport.—Shackleton Sales Week-end; until Apr. 30.

Harrow.—The Society of Weight Engineers, London Branch Forum on " Design, Manufacture and Operation of Aircraft," at Lascelles School, Shaftesbury Avenue, Harrow, at 19.00 hrs.

London.—B.I.S. One-day Symposium on "Liquid Hydrogen as a Rocket Propellent," from 10.00 hrs. to 17.00 hrs.

Company Notices

NEW COMPANY

Fliteform, Ltd. (687,491).—Private co. Reg. Mar. 23. Cap. £1,000 in £1 shs. To carry on the business of aeronautical and general engineers, electrical, atomic, electronic, mechanical and production engineers.

New Patents

APPLICATIONS ACCEPTED

868,586.—**Aeroquip Corporation.**—" Automatic release hook."—Jan. 12, 1959. (Apr. 7, 1958.)

868,017.—**English Electric Co., Ltd.**—" Arrangement of jet propulsion engines and undercarriages in aircraft."—Oct. 13, 1959. (Oct. 14, 1958.)

868,075.—**Curtiss-Wright Corporation.**—" Apparatus for simulating the operation of reciprocating aircraft engines."—Jne. 28, 1957. (Jly. 5, 1956.)

868,199.—**Sperry Rand Corporation.**—" Aircraft control system."—Jne. 27, 1957. (Jne. 28, 1956.)

868,390.—**Vickers Aircraft Holdings, Ltd.**—" Doors for pressurized fuselages of aircraft."—Jne. 9, 1959. (Jly. 4, 1958.)

Printed specifications of the above will be available on May 17, 1961, and the opposition period will expire on Aug. 17, 1961.

868,818.—**Kenyon Laboratories, Inc.**—" Apparatus for visually indicating the translatory motion of helicopters."—Jan. 22, 1959.

868,871.—**W. W. Triggs (Bell Aircraft Corporation).**—" Vertical take-off and landing aircraft."—Mar. 31, 1959.

869,065.—**Sebac Nouvelle S.A.**—" Aircraft wings." Feb. 4, 1958. (Feb. 7, 1957.)

Printed specifications of the above will be available on May 24, 1961, and the opposition period will expire on Aug. 24, 1961.

Personal Notices

BIRTHS

Bazalgette.—On Mar. 28, at R.A.F. Station, St. Mawgan, to Aleatha Nell (*née* Wicker), wife of Wg. Cdr. J. E. Bazalgette—a daughter.

Black.—On Mar. 31, at Market Harborough, to Patricia, wife of Sqn. Ldr. F. A. Black, R.A.F. (retd.)—a son.

Bloom.—On Mar. 25, at Münster, West Germany, to Nancie (*née* Taylor), wife of Flt. Lt. P. Bloom—a son.

Buchanan.—On Apr. 6, to Diana-Louise, wife of Sqn. Ldr. R. J. T. Buchanan—a son.

Clifford.—On Mar. 28, at Brighton, to Fay (*née* Potter), wife of Flt. Lt. J. M. Clifford—a daughter.

Darroch.—On Apr. 3, at R.A.F. Hospital, Nocton Hall, to Moyra, wife of Flt. Lt. T. Darroch—a daughter.

De Thier.—On Apr. 6, at R.A.F. Hospital, Halton, to Audrey (*née* Reid), wife of Sqn. Ldr. R. De Thier—a son.

Gordon.—On Mar. 30, at the R.A.F. Hospital, Wegburg, to Colleen (*née* Wynell-Mayow), wife of Flt. Lt. W. L. Gordon—a daughter.

King.—On Apr. 2, at Church Fenton, to Veronica (*née* Browne), wife of Sqn. Ldr. R. P. J. King—a daughter.

Lavender.—On Apr. 2, at Rinteln, to Audrey (*née* Midwinter), wife of Flt. Lt. N. D. Lavender—a daughter.

MacBean.—On Apr. 1, at R.A.F. Marham, to Pauline, wife of Sqn. Ldr. J. A. MacBean—a son.

McKenzie.—On Apr. 5, at R.A.F. Hospital, Halton, to Betty, wife of Flt. Lt. L. B. McKenzie—a son.

Paget.—On Apr. 6, at Mtarfa, Malta, to Wendy (*née* Payne), wife of Flt. Lt. John Paget—a daughter.

Stillwell.—On Apr. 1, at Farnborough, Kent, to Jean (*née* Livingstone), wife of Sqn. Ldr. F. Stillwell—a daughter.

Taylor.—On Apr. 4, at Drayton, to Sally (*née* Gunning), wife of Flt. Lt. A. Taylor—a son.

MARRIAGES

Farrell-Purchase.—On Apr. 1, Flg. Off. Clifford Linsay Farrell, to Pearl Elizabeth May Purchase.

Hill-Marsh.—On Apr. 1, Plt. Off. Ian James Cowan Hill, to Pamela Marsh.

DEATHS

Box.—On Apr. 1, Flt. Lt. Alfred Box, M.B.E., R.A.F. (retd.).

Ockenden.—On Mar. 31, Sqn. Ldr. Edward Frank Ockenden, O.B.E., R.A.F. (retd.).

Ryan.—On Mar. 30, Air Cdre. R. W. Ryan, R.A.F. (retd.).

Have you seen an Airedale?

THE AEROPLANE and ASTRONAUTICS CLASSIFIED ADVERTISEMENTS

PRESS DAY: Classified Advertisements must normally be received at Head Office by FIRST POST THURSDAY for the following Thursday's issue. Last-minute additions and deletions are accepted by telephone from trade advertisers up to noon. Advertisements received too late for a particular issue are automatically inserted in the succeeding one unless instructions to the contrary are received.

RATES—1/- per word (minimum 12 words 12/-). Each paragraph charged separately and name and address must be paid for. Semi-displayed setting £3-17-6 per single column inch. Centred lines 22/6. Series discounts of 5% for 13, 10% for 26 and 15% for 52 consecutive insertions, allowed to trade advertisers.

TERMS—Strictly net and prepayable. Monthly accounts for settlement by the end of the month following insertion are allowed to trade advertisers if satisfactory references are provided.

REMITTANCES—Cheques and postal orders should be crossed and made payable to TEMPLE PRESS LIMITED and instructions sent addressed to the Manager, "The Aeroplane and Astronautics," Bowling Green Lane, London, E.C.1.

DEPOSIT SYSTEM—Facilities are available to readers to purchase advertised goods through "The Aeroplane and Astronautics." Commission 1% (minimum 2/-) on amount deposited.

BOX NUMBERS—Private advertisers desiring to have replies sent care of "The Aeroplane and Astronautics," may do so on payment of 1/- to cover booking and postage, plus cost of four extra words. Box Numbers must not be used for the purpose of circularizing and the Proprietors do not undertake the distribution of such matter received. To avoid mistakes in forwarding, Box Numbers should be carefully and legibly copied and replies sent to Box A000, care of "The Aeroplane and Astronautics," Bowling Green Lane, London, E.C.1.

THE PROPRIETORS retain the right to refuse or withdraw advertisements at their discretion and are not responsible for clerical or printers' errors, although every care is taken to avoid mistakes.

HEAD OFFICES: Bowling Green Lane, London, E.C.1, England. Telephone: Terminus 3636. Telegrams: "Pressimus London Telex." Telex: 23839.

BRANCH OFFICES: Bayliss House, Hurst Street, Birmingham, 5. Telephone: Midland 6616. 50 Hertford Street, Coventry. Telephone: Coventry 27414. 1 Brazennose Street, Manchester. Telephone: Deansgate 6114–8. 12 Renfield Street, Glasgow. Telephone: Glasgow Central 1413.

---

30 YEARS EXPERIENCE & SERVICE

LIGHT AND EXECUTIVE AIRCRAFT DIVISIONS

Just a reminder that the Shackleton Aviation Weekend, already firmly established as Britain's only

INTERNATIONAL AIRCRAFT SALE AND DISPLAY

will take place this year at Coventry (Baginton) Airport on Friday, Saturday and Sunday, 28th, 29th and 30th April.

This is the only opportunity of the year to examine such a wide collection of new and used private, executive and business aircraft available for sale. Over 50 brand new aeroplanes are already booked to appear and an equal number of used aeroplanes of every type.

Demonstration flights will take place throughout the Meeting.

For the greatest international civil aviation display in Britain we invite you to join us at Coventry.

For the widest possible selection of aircraft at any time, we invite you to deal with Shackletons.

TRANSPORT AIRCRAFT DIVISION

- ★ Series 5 and 6 de Havilland Doves, new in 1955, with airframe hours less than 3,000 each.
- ★ Zero hours since Check V overhaul and complete reconditioning by de Havillands.
- ★ Zero hours on engines and propellers since overhaul by de Havillands.
- ★ New cabin interiors in airline or executive configuration.
- ★ Full de-icing, 52 gallon long range tank, metal floor, dual controls.
- ★ Less than half new price, these are the finest used Doves ever offered.
- ★ Subject to remaining unsold.

NEW OR USED AIRCRAFT SUPPLIED **CREDIT TERMS ARRANGED** **PART EXCHANGE WITH OTHER AIRCRAFT OR CARS**

Cables: Shackhud, London

W.S. SHACKLETON AVIATION LIMITED

175 PICCADILLY, LONDON, W.1
HYDE PARK 2448/9

EUROPE'S LEADING AIRCRAFT TRADERS

AIRCRAFT FOR SALE
R. K. DUNDAS, LTD.

A MIXED BAG.

AUSTER AIGLET, Cirrus Major III, 200 s.c.o., C. of A., December, 1961, MR.100, navigation-cabin-landing lights, generator, full gyros, dual silencer, 32-gal. tanks, £1,600.

AUSTER AUTOCRAT, Cirrus Minor II, 234 s.c.o., C. of A. February, 1962, dual 3 seats, basic, but in very good condition, £875.

AUSTER AUTOCRAT, Cirrus Minor, nil s.c.o., new C. of A., L.R. tank, gyro panel, VHF, battery, generator, £1,450.

CHIPMUNK, Gipsy Major X Mk. II, nil s.c.o., new C. of A., completely zeroed since conversion, and thus virtually a new aircraft, 10-channel VHF, full panel, 24-gal. tank, electric starter, all modifications, £3,000.

CHIPMUNK, C. of A. expired, 431 hrs. on engine s.c.o., standard tanks, 4-channel VHF, £2,045 as is, or £2,400 with C. of A.

CESSNA 310, with far more equipment than we have space in which to mention it, 800 hrs. since new, 1956, with zero-houred engines, and undoubtedly the finest available in U.K., £16,150.

PLUS, of course, the full Jeppesen range of products. Take another look at your old protractor—is it now completely opaque and curling at the edges?

THEN try the new PN-1 Plotter, contains compass rose, scale rule, conversions, million and half-million scales, etc. Make life a little easier and safer, for £1 2s. 1d.

R. K. DUNDAS, LTD., Dundas House, 59 Saint James's St., London, S.W.1. Phone, Hyde Park 3717. 583-27

GRANTAIR, LTD.

GRANTCHESTER, CAMBRIDGE.
Phone, Trumpington 3132 (24 hours per day).

YOU have a licence—we have aircraft. Recent C. of A. (private or hire and reward). H.P. or leasing. British and American, two, four or more seats, with or without radio, £1,000 to £10,000. Demonstrations anywhere, any time. Hire one for a week before you buy it. See also aircraft for hire and charter. zzz-768

A Handley Page Marathon, only 1,000 hours since new C. of A. expires July, 1961, fully airline equipped including radio, 20 seats, V.I.P. interior, immediate delivery, £6,500.

DOVE users, propeller, C.S.U.s, starters, Gipsy Queen 70/4s, all nil hours, overhauled by makers.

MILES Gemini, Mark 1A, full dual control, radio, many extras. Derby Aviation, Limited, Derby Airport. Phone, Etwall 521. 585-570

PIAGGIO of GENOA

See the **Piaggio P.166 LUXURY EXECUTIVE** Shackleton Aviation Weekend — Baginton April 28-30

British Representatives:

AERO-ENTERPRISES
(Boreham Wood) Ltd
17 Drayton Rd. Boreham Wood, Herts. ELS 2688

TWIN BEECHCRAFT
D18S (C45H)
from $7500
Depending on engine T.S.O.

These are the military C45H, the same as D18S civil model, with 6 or 9 place interior, lined and soundproofed, hydromatic props, auto pilot, radio including ADF, and dual instruments.

50 planes in perfect flying condition and complete with ferry permits to choose from. Let us quote you on C. of A. for export, custom interiors and flight delivery.

Write: Mr. G. R. Board *Cables: SELAIR*

AERO AMERICAN CORP.
808 N. Erin Blvd. Tucson, Arizona, U.S.A.

1960 Model Cessna 180 in as new condition, 370 hours total, air frame and engine, distributor maintained, complete with full panel, dual controls, tinted shields, rotating beacon, carburetter temp, pitot heat, abrasion boots, many extras and including Narco Omnigator 27 channel VHF radio with Omni indicator ILS localizer Marker beacon receiver, etc., £6,950, can be supplied with following brand new equipment already installed: Narco ADF 29 all transistorized radio compass, £500 extra and King KY 100 Nac Com 100/190 channel crystal tuned VHF set with VOR/ILS indicator and audio panel £975 extra. List price £9,500. Lotus Cars, Delamare Rd., Cheshunt, Herts. 583-x3446

JODEL MUSKETEER.

4-SEATER, 200 lb. baggage, or 5-seater with adequate luggage, six hours' range at 140 m.p.h., will operate with full load from fields of 250 yd., with luxurious furnishing, gyro compass and horizon at only £4,816; fly away Redhill Aerodrome. Try it yourself—contact

ROLLASON AIRCRAFT AND ENGINES, LTD.,

CROYDON AIRPORT.
Phone, Croydon 5151-52. 583-18

PETER S. CLIFFORD AND CO., LTD., offer:—

EXECUTIVE Dove II, total airframe hours 1,260, engine hours port and starboard 766, propellers port and starboard 152, 12 months' C. of A., STR9Z and Marconi ADF, £9,995 o.n.o. Further details on request.

SOLE U.K. agents for Czechoslovakian light aircraft. Oxford Airport, Kidlington, Oxford. Kidlington 3355, Bletchington 392. 583-10

Aircraft Wanted

SCRAP aircraft aluminium and stainless steel urgently required. Lowton Metals, Ltd., Lowton St. Mary's, near Warrington. Leigh 71441-2. zzz-0766

AIRCRAFT ACCESSORIES, SPARES AND COMPONENTS

ROLLASONS for Tiger Moth spares, Gipsy engine overhauls and spares and now increased facilities at Biggin Hill for your C. of A. overhaul. All light aircraft types acceptable. zzz-775

THE REGIONAL AIR TRADING CO., Croydon Airport, for Rapide spares of every description. Phone, Croydon 8521. zzz-762

Aircraft Accessories, Spares and Components—contd.

PHILLIPS AND WHITE, LTD.

THE leading stockists in the U.K. for instruments, navigational equipment, electrical components and parts, and engine accessories. Spares for de Havilland Gipsy, Major and Queen series and Armstrong Siddeley Cheetah IX, X and XV engines.
61 QUEEN'S GARDENS, London, W.2. Phone, Ambassador 86511, 2764. Cables, "Gyrair, London." zzz-772

REPAIRCRAFT, LTD., The Common, Cranleigh, Surrey (Cranleigh 536), for instruments and auto-pilot overhaul. zzz-749

PARACHUTES, 24 ft. nylon back-type, £10 each, ditto seat-type, £8 each. Further details from H. H. Bradford, Ltd., Ramsey, Harwich, Essex. 584-556

PLUGS and sockets. More than 1,000,000 in stock, covering over 50 different ranges. British and American. Stock list on application to: Sasco, Nutfield, Redhill, Surrey. Phone, Redhill 5050. zzz-784

BENDIX J-8 Horizons, instruments, relays for Dakotas, Sabres, Neptunes, Bendix VOR-ILS, radio and compass equipment. Fairchild Aircraft, Cameras, Gun Cameras and Spares. E.W.S. Co., 69 Church Rd., Moseley, Birmingham. 583-536

AIRFRAME spares for Dakotas, Harvards, Piper Cub, Fairchilds, Argus, Beechcraft, D-17s, Mosquito, Spitfire, Firefly. Engine spares for Pratt & Whitney, Armstrong Siddeley, Lycoming, etc., accessories and instruments for all types of aircraft.
C.47 Dakota operators please note, we offer a limited number of genuine brand-new Bendix 52058 tail wheels at a reasonable price.
A. J. WALTER, LTD., The Drive, Horley, Surrey. Phone, Horley 1420 and 4294. Cables, "Cubeng Horley." 583-22

SEAT-TYPE nylon parachutes, 28-ft.-diameter, American manufacture, £15 each, complete. Bradfords, Ramsey, Harwich, Essex. 588-572

AIRCRAFT SERVICING

HANTS AND SUSSEX AVIATION, LTD., Portsmouth, have now obtained additional hangar space and can offer facilities for C. of A. overhauls, modifications and all types of repairs. Phone, Portsmouth 62087. 583-1

HELICOPTERS

FOR specialized helicopter operations in engineering and survey, agricultural spraying, passenger transport, flying training—contact Helicopter Services, Ltd., Luton Airport. Phone, Luton 4911. zzz-783

AVIATION COMPUTERS

KAYS, of Ealing, stockists of Aristo, Jeppesen, Weems, Swissair, R.A.F. Mk. 4, Box Dalton, computers; scale rules, protractors, etc., quotations, mail order, by return. Write for latest stock list, 8-10 Bond St., Ealing, W.5. Eal 2813. 583-787

CLOTHING

R.A.F. Officers' uniforms for sale, new and reconditioned. Fisher's, 86-88 Wellington St., Woolwich. Phone 1055. Kits also purchased. zzz-774

CONSULTANTS

R. W. SUTTON (CONSULTANTS), LTD., 7 Lansdowne Place, Cheltenham. Phone 5811. 588-539

IAN S. McNICHOL, London School of Air Navigation. Pilot and navigator training with advisory service. 33 Ovington Square, Knightsbridge, S.W.3. zzz-791

ELECTRICAL EQUIPMENT

ELECTRICAL connectors. More than 1,000,000 in stock, covering over 50 different ranges. British and American. Stock lists on application to Sasco, Nutfield, Redhill, Surrey. Phone, Redhill 5050. zzz-785

ENGINES—WANTED

CONTINENTAL 75 h.p. engine in good condition. Parkin, Coral Gables, Mont a. l, Abbe, Jersey. 583-6

I FLY PIPER

Sole Distributors in the U.K.

VIGORS AVIATION LTD. OXFORD AIRPORT. KIDLINGTON 3444

The lowest priced Copter in the World. Bensen B-7 Gyro-Glider and B-7Mc powered Gyro-Copter. In production by arrangement with Bensen of U.S.A.

For full details send P.O. 5/-

CAMPBELL

Laundry Lane, Hungerford, Berks.

HIRE AND CHARTER

GRANTAIR, LTD.,

GRANTCHESTER, CAMBRIDGE.

Phone, Trumpington 3132 (24 hours per day).

You have a licence—we have aircraft with or without pilot, with or without radio, two or four seats. Tri-Pacers, Caribbeans, Cubs or Austers, for hire or lease. (Free maintenance, insurance and repairs.) From £3 10s. per engine hour without pilot or 1s. 3d. per mile with pilot.

Europe—Africa or Asia covered. See also Aircraft for Sale. zzz-769

HIRE-PURCHASE

HIRE-PURCHASE on your own plane. We will buy your machine and hire-purchase it back to you over three years. Raymond Way Motors, Ltd., Kilburn, N.W.6. Maida Vale 6044. 583-786

PACKING AND SHIPPING

R. AND J. PARK, LTD., 143-9 Fenchurch St., E.C.3. Phone, Mansion House 3083. Official packers and shippers to the aircraft industry. zzz-782

PERSONAL

HISTORIC HOUSE. Concession on privileged terms can be given to fly around sensational East Anglian dwelling. Box A832, care of THE AEROPLANE AND ASTRONAUTICS. 583-16

PHOTOGRAPHY

AEROPLANE photographs, 5,000 available, including 1914-19 warplanes, latest U.S.A. and British jets, 5½ in. by 3½ in., 8s. per dozen. Lists and specimens, 2s. 6d. post free. Also thousands of ships and railways. Real Photographs, Ltd., Victoria House, Southport. 583-2

RADIO AND RADAR

SPERRY ZERO reader, Type ZLI course selectors, control panels, flight computers and indicators, three complete installations in stock. A. J. Whittemore (Aeradio), Ltd., Biggin Hill Aerodrome, Kent. zzz-780

STR12D, STR9Z, STR9X and most other British and American V.H.F. R/T equipment always in stock. A.R.B.-approved design installations into any type of aircraft. A. J. Whittemore (Aeradio), Ltd., Biggin Hill Aerodrome, Kent. zzz-781

SITUATIONS VACANT

McALPINE AVIATION have immediate vacancy for additional Company Pilot. Apply Aviation Manager, Sir Robert McAlpine and Sons, Ltd., Luton Airport, Luton, Beds. 583-569

PILOTS, Viscount Captains and First Officers required. Maitland Drewery Aviation, Gatwick Airport. 585-568

. . . it's Continental

. . . it's elegant

the new

META-SOKOL

light executive aircraft

★ RETRACTABLE UNDERCARRIAGE
★ V.P. PROPELLER
★ Fuel Injection for economy and safety
★ Cruises at 127 m.p.h. with a consumption of only 4½ g.p.h. (28 m.p.g.)
★ Comfortable 4 seat cabin with exceptional all round view
★ Comprehensive standard equipment
★ Full spares backing

Enquiries welcomed for the Meta-Sokol and the Light-Twin Aero 145

SOLE U.K. AGENTS

PETER S. CLIFFORD & Co. Ltd.
Oxford Airport, Kidlington

Phone Kidlington 3355
Evening and W/Ends Bletchington 392

in conjunction with G/C Edward Mole, U.K. Distributor.

World Wide Distributors OMNIPOL, PRAGUE

BUSINESS AIRCRAFT

Beechcraft

Available from Shorts

The Queen Air

Introduced only last year, this superb aeroplane carries seven people for an I.F.R. range of 850 miles with full airline allowances at 192 m.p.h. Details of this and other Beechcraft models may be obtained from the British Isles distributors—

SHORT BROTHERS & HARLAND LTD

Light Aircraft Division | Queen's Island, Belfast, N. Ireland or The Aerodrome, Rochester, Kent

The 182

Cessna

APPOINTED DEALERS

Midlands: Sir Robert McAlpine and Sons Ltd. Luton Airport, Luton, Beds

East Anglia: W. H. & J. Rogers (Engineers) Ltd. Gt. Barford, Bedford

North: Westair Limited Squires Gate Airport, Blackpool, Lancs

Scotland: Airwork Services Limited Perth Aerodrome, Perth, Scotland

SOLE DISTRIBUTORS IN GREAT BRITAIN ARE

AIRWORK SERVICES

PANSHANGER AERODROME · HERTFORD

TELEPHONE ESSENDON 315

Don't buy any spares for

★ DC-4
★ Viscount
★ Viking
★ Bristol 170

until you have consulted

AIRLINE AIR SPARES LTD.

who carry comprehensive ranges of spares and major components for all these aircraft.

Never used an Ansafone?
Telephone your orders in the evening when calls are cheaper and you will find out how it works.

Airline Air Spares
LTD.

Associated with

T. D. Keegan Ltd.

SOUTHEND AIRPORT
SOUTHEND-ON-SEA, ESSEX

Telephone: ROCHFORD 56881-2-3 Telex 1943

For A.O.G. service after office hours contact:
MR. EDWARDS—SOUTHEND 47828
MR. NOBLE—SOUTHEND 43863

17-25 . . . with G.C.E.?
Fly as an officer in the R.A.F.

A few weeks at Initial Training School, then as an acting Pilot Officer flying the Jet Provost . . . advanced training . . . then your 'wings' . . . and finally, training to fly the aircraft of the Command for which you are selected. An adventurous, satisfying career that can take you all over the world . . .

If you are fit, between the ages of 17 and 25, and hold G.C.E. at 'O' level (or equivalent) in five acceptable subjects including English language and mathematics, this could be your life as an officer flying in the Royal Air Force.

You will be well paid from the very beginning of your career. As a Flying Officer of 21 you will earn £950 a year. As a Flight Lieutenant of 25 drawing full allowances you could earn over £1,750.

Length of Service. You may serve to the age of 38 or the age of 55. Alternatively, you may leave after 8 or 12 years. There are a few commissions that allow you to leave after 5 years. All periods of service entitle you to a tax-free gratuity—from £775 after 5 years, to £4,000 after 12 years. If you retire after 16 years or more, you will qualify for a pension of at least £455 a year as well as a minimum tax-free gratuity of £1,365.

Write for further details, giving your date of birth and educational qualifications, to: Group Captain J. N. Ogle, A.F.C., A.F.M., Air Ministry (A.P. 811), Adastral House, London, W.C.1.

THE FUTURE IS WITH THE R.A.F.

CUNARD EAGLE AIRWAYS LIMITED

LONDON AIRPORT · HOUNSLOW · MIDDX.

require

RADIO ENGINEERS
(Ref.: M.10.)
with 'A' Licence and Rating
(or of near Licence Standard)
Starting rates from £930 p.a.

ONE OR TWO HIGH GRADE RADIO MECHANICS
(Ref.: M.3.)

'X' LICENSED INSTRUMENT AND ELECTRICAL ENGINEERS AND INSPECTORS
(Ref.: M.4.)

AIRCRAFT INSTRUMENT MECHANICS AND ELECTRICIANS
(Ref.: M.18.)

LICENSED AIRCRAFT ENGINEERS, INSPECTORS AND CHARGEHANDS
experience with Britannia, Viscount and DC.6 Aircraft is essential
(Ref.: M.12.)

Salaries—Engineers and Inspectors £930-£1,240 p.a.

Salaries—Chargehands, £13-£16 per week

All Applications in writing, quoting the appropriate reference, to the Personnel Officer

THE BRITISH AIRLINE PILOTS ASSOCIATION
81, New Road, Harlington, Middx. *Tel. HAYes 3442/3*

Membership open to all Commercial and Service Pilots. For full details as to Objects and particulars of Membership, please write to General Secretary.

BRITISH
WIRE THREAD INSERTS
Precision made in Carbon Steel for Aluminium and Magnesium. Also in Stainless Steel and Bronze.
B.S.F. · Metric · B.S.P. · B.A.
Whitworth · Unified
CROSS MANUFACTURING CO. (1938) LTD
COMBE DOWN BATH SOMERSET

Situations Vacant—contd.

TRADAIR, LTD., require Licensed and Unlicensed Aircraft Electricians and Instrument Engineers with Viscount experience. Please apply to Chief Engineer, Tradair, Ltd., Southend Airport, Essex. 584-567

LANCASHIRE AIRCRAFT CO.

THIS company, engaged in the design and manufacture of light aircraft, invite applications for the following position:—

CHIEF STRESSMAN.

A Chief Stressman is required to take charge of all stress analysis and mechanical test work. Minimum qualifications that will be considered are H.N.C. and four years' aircraft stressing experience. AN attractive salary will be offered, depending on qualifications and experience. Apply in the first instance to:—
CHIEF DESIGNER, Lancashire Aircraft Co., Ltd., Samlesbury Airfield, near Blackburn, Lancashire. 583-12

LICENSED engineer, Category A and C, on light aircraft, including American aircraft. Westair Flying Services, Blackpool Airport. 583-x3258

MINISTRY OF AVIATION.

AIR TRAFFIC CONTROL OFFICERS.

Posts for men or women at least 23 and under 35 on 1.7.61. Candidates must have had recent aircrew experience, preferably as pilot or navigator in civil air transport or H.M. Forces; but exceptionally, extensive experience in A.T.C.O. duties may be accepted. They should normally also have G.C.E. with five passes, or an equivalent academic qualification. Starting salary (London) from £872 to £1,251. Maximum £1,599.

Appointment initially unestablished, but prospects of establishment and promotion.

APPLY
MINISTRY OF AVIATION,
EST 5(a) 1/R758,
THE ADELPHI,
JOHN ADAM STREET, LONDON, W.C.2. 583-8

FLYING instructor at Exeter Airport, good salary, pension fund. Apply to the Manager, Exeter Airport, Exeter. Phone, Exeter 67433. 583-4

FLIGHT ENGINEERS

BRITISH OVERSEAS AIRWAYS CORPORATION

INVITE APPLICATIONS FOR EMPLOYMENT
as
ENGINEER OFFICERS
(FLIGHT ENGINEERS)

Applications are invited to fill a limited number of vacancies for Engineer Officers in the immediate future and later in 1961. Candidates should be between 21 and 36 years of age, and their medical standard should not be less than that required for the Flight Engineer's Licence. Qualifications required are a high standard of education, at least two year's experience in aircraft maintenance, including both engines and airframes, in addition to academic engineering training, or an apprenticeship in aeronautical engineering or its equivalent with adequate practical experience in maintenance of modern heavy aircraft or two years' experience as a Pilot or Flight Engineer with a good practical maintenance engineering experience in addition.

Desirable additional qualifications are the possession of a Maintenance Engineer's Licence endorsed in categories "A" and/or "C" applicable to heavy aircraft. In any case, applicants will be expected to reach this technical standard after training. Applicants will be required to undergo aptitude tests and to sit an examination designed to test basic mathematical and engineering knowledge. Those reaching the required standard will be called to attend a Selection Board. Successful applicants will be appointed for a probationary period, including training to enable them to obtain the Flight Engineer's Licence. During this time they will receive a salary within the bracket of £875-£940 per annum. On appointment as an Engineer Officer a starting salary of £1,150 per annum is payable, rising to £2,275 per annum, maximum.

Write for Application Form to
RECRUITMENT AND POSTINGS SUPERINTENDENT, (FLYING STAFF),
B.O.A.C.
LONDON AIRPORT,
HOUNSLOW, MIDDLESEX. 583-14

A And C Licensed Engineer (covered on light aircraft), permanent position, good wages and opportunities. Apply Chief Engineer, Tyne Tees Air Charter, Woolsington Airport, Woolsington, Newcastle upon Tyne. 583-566

Situations Vacant—contd.

TRANS-MEDITERRANEAN AIRWAYS SAL., Beirut, require freelance DC4 Captains with a minimum of 1,000 hours on type, during May and June, 1961. Guaranteed a minimum of 200 hours flying during this period of £5 per hour. Apply with photostatic copies of licences to Davies Turner and Co., Ltd., 4 Lower Belgrave St., London, S.W.1. 583-565

DOVE A and C licensed aircraft engineers required for overseas duties, good pay with local allowances and free accommodation. Apply Chief Engineer, Morton Engineering Services, Gatwick Airport. Phone, Livingstone 8855, ext. 60. 586-571

BRITISH UNITED AIRWAYS

invites applications from Engineers holding the following "A" and "C" Licences; "A" Licence valid for Twin Pioneer and Heron, "C" Licence valid for Alvis and Gipsy Engines; for the position of

STATION ENGINEER

WITH

SIERRA LEONE AIRWAYS

AT

FREETOWN, SIERRA LEONE.

Remuneration will be by salary plus generous cost of living allowances with free accommodation and means of transport. Two months' annual leave in the United Kingdom with free passage will be provided.

Apply in writing to

PERSONNEL MANAGER,
BRITISH UNITED AIRWAYS,
GATWICK AIRPORT,
HORLEY, SURREY. 583-11

UNLICENSED radio mechanic and instrument mechanic required for Persian Gulf area, suit ex-service personnel, good pay and allowances. Apply The General Manager, Airwork Services, Ltd., Bournemouth (Hurn) Airport, Christchurch, Hants. 583-13

BRITISH COUNCIL.

ETHIOPIA.

THE Imperial Ethiopian Air Force College of the Air at Debra Zeit, near Addis Ababa, with at present about 125 pupils, established in 1958 to provide training for those intending to enter the Imperial Air Force and run on British lines with a British headmaster, requires for September, 1961: (i) two Instructors to teach English to "O" level; and (ii) one to teach Technical Drawing and Applied Mathematics at least to "O" level with elementary Science. Candidates for (i) must be qualified teachers, graduate and/or trained, and for (ii) must be graduates or have the Higher National Certificate or equivalent qualifications. R.A.F. experience would be a recommendation.

SALARY: Ethiopian dollars 10,800 p.a. tax free (equivalent at present rate of exchange to £1,542 sterling p.a.). Installation grant of half a month's salary. Free accommodation with basic furniture. Return fares paid for instructor and family. Three-year contract with possibility of renewal. Opportunity to teach in the evening institute of the Air Force for additional remuneration.

WRITE, quoting P.12.A(61), and enclosing stamped and addressed foolscap envelope, to Director, Recruitment Department, British Council, 65 Davies St., London, W.1, for further particulars and an application form. 583-25

BRISTOL (LULSGATE) AIRPORT. Club instructor required, congenial conditions. Commercial licence with assistant instructor's rating preferred, permanent position. Apply Bristol and Wessex Aeroplane Club, Ltd. 583-23

BEA Appointments

TECHNICAL OFFICER — **South Ruislip**

for operational research work and investigation into operational deficiencies of communication and radio air systems used in BEA aircraft. He will also represent BEA at national and international discussions on planning and implementation of such systems. A Science degree or equivalent qualification and significant experience in the field of aeronautical navigation and communications is essential. Flying experience an advantage. Salary range £1237—£1750. Box 331

NAVIGATION INSTRUCTOR — **Hatton Cross**

An experienced Instructor with Flight Navigator's Licence and knowledge of aircraft performance as required for ARB endorsement examinations, to lecture Pilots on navigation and allied subjects, also to prepare lecture notes and instructional aids. Familiarity with European routes and radio aids an advantage. Salary range £996—£1292. Box 332

ENGINEER/MATHEMATICIAN — **Hatton Cross**

A good opportunity for a man with a degree in Mathematics and recent experience of industrial computer applications, preferably in aircraft design, to study the application of computer techniques to planning and analysis of development flight testing and other associated work. Salary range £1005—£1367. Box 333

FLIGHT SIMULATOR ENGINEER — **Heston**

for maintenance, overhaul and minor development work on electronic flight simulators. He should have served a recognised engineering apprenticeship, possess ONC (Electrical) or its equivalent and be experienced in the maintenance of electronic equipment. Salary range £930—£1140 plus shift pay. Box 334

STATION CHARGEHANDS — **Heathrow & Guernsey, C.I.**

Men with A and/or C licences on Viscount/Dart to supervise pre-departure checks, defect diagnosis and rectification on Viscount, Comet and Vanguard aircraft at London Airport. Good qualities of leadership, at least five years' practical experience and the ability to extend existing qualifications on introduction of new aircraft types. Salary range £16.14.0—£19.14.0 plus special bonus and supplement totalling 73/6 and, in addition, generous shift pay. Box 335

A suitably qualified man is also required to supervise airframe and engine maintenance at Guernsey Airport. He should have a sound technical knowledge of aircraft defect rectification procedures and possess A and C licences on Viscount and Dakota aircraft. Salary range £16.5.6—£19.5.6 plus 33/6 special bonus. Box 336

All the above posts are permanent and pensionable with excellent conditions of service and good career prospects.

Please send a full personal history, in confidence, to Personnel Services Manager, Bealine House, Ruislip, Middlesex, ensuring that the box number is marked on the envelope.

BRITISH EUROPEAN AIRWAYS

Hawker Siddeley Aviation LIMITED

vacancies in

PERFORMANCE & SALES ENGINEERING

on the new successful

AVRO 748 TURBO PROP AIRLINER

There are a limited number of senior and junior vacancies for personnel in the Performance and Sales Engineering groups of A. V. ROE & CO. LTD.

The work is connected with Performance Analysis, Route Studies, Market Survey, Operational Costs and Preparation of Flight Performance manuals.

Applicants should have some previous experience and be prepared to travel.

Apply giving general particulars of age, qualifications and experience to:—

The Personnel Manager, **A. V. ROE & CO. LTD.**, Greengate, Middleton, Manchester.

Situations Vacant—contd.

INDEPENDENT airline urgently requires pilots for Rapide aircraft, must have C.P.L., instrument rating and performance A, positions superannuated, good basic salary, very interesting positions with opportunities of advancement for right man. Apply Box A831, care of THE AEROPLANE AND ASTRONAUTICS. 583-15

EAST AFRICAN AIRWAYS CORPORATION require First Officers with DC-3 experience, flying minimum 1,900 hours, preferably aged 26-30, multi-engine experience an advantage. Pilots with limited experience will not be considered. Three-year tour with local/U.K. leave, housing, medical, pension facilities. Apply to Personnel Manager, B.O.A.C. Associated Companies, Ltd., Airways Terminal, Buckingham Palace Rd., S.W.1. Victoria 2323, ext. 116. 583-24

LICENSED Aircraft Engineer required as deputy to chief engineer on small unit keeping fleet of Chipmunks and Austers hard at work. Chance for man with initiative and enthusiasm. Apply by post, please, to the Manager, The London School of Flying, Ltd., Elstree Aerodrome, Herts. 583-26

COLLEGE OF AIR TRAINING,
HAMBLE, SOUTHAMPTON.

CHIEF ENGINEER.

Applications are invited for the post of Chief Engineer to commence as soon as possible after appointment.

Applicants must be fully qualified ground engineers and under 50 years. The Chief Engineer is responsible for the maintenance and overhaul of the College fleet of 30 aircraft (Chipmunk and Piper Apache), organization and maintenance of the aerodrome crash and fire services, supervising the maintenance and overhaul of 18 vehicles, provisioning and stock control of technical stores and for the direction, control and training of the maintenance staff of 70 men.

Salary £1,500 x £50 to £1,750 per annum. Contributory pension scheme.

Applications in writing by not later than May 1, giving full particulars, to Principal. 583-7

LICENSED aircraft engineer required by the Wolverhampton Aero Club at Wolverhampton Airport. Must hold A and C on current light types, be conversant with everyday maintenance and C of A overhaul work.

ALSO required, a capable fitter-rigger accustomed to the above class of work, whose intention it is to obtain licences at a later date.

WRITE in first instance to:—The Manager, Wolverhampton Aero Club. 583-5

WIND TUNNEL ENGINEER.

The Aerodynamics Section of the National Aeronautical Establishment requires a Wind Tunnel Engineer to take charge of the operation of a low-speed wind tunnel; to investigate and develop model testing techniques; to specify related electronic and mechanical equipment. This engineer will have the opportunity to apply initiative and ingenuity in the field of aerodynamic testing with support from specialists in mechanical design, instrumentation and data handling.

Candidates must have an engineering degree, some experience in wind tunnel or other aeronautical research equipment and a desire to participate in experimental work.

Initial salary commensurate with education and relevant experience.

Apply to:—
THE EMPLOYMENT OFFICER,
NATIONAL RESEARCH COUNCIL,
SUSSEX DRIVE,
OTTAWA 2, ONTARIO,

Giving full details of education and experience.
In reply please quote NAE-53. 583-9

STRESSMEN and Draughtsmen required for interesting and varied work mainly in the aircraft industry. Excellent starting salaries to men with suitable experience and qualifications. Postcard for details: Stress and Allied Engineers, Ltd., 7 Warrender Way, Ruislip, Middlesex. 583-x3522

VIKING captains and first officers wanted. Apply Chief Pilot, Pegasus Airlines, Gatwick Airport. 583-21

VIKING captains and first officers required for Blackpool base. Apply, Chief Pilot, Pegasus Airlines, Squires Gate Airport, Blackpool. 583-20

SENIOR Traffic Officer able to work on own initiative and take charge of handling unit at Gatwick Airport. Write in confidence to Managing Director, Pegasus Airlines, 236 Old Bedford Rd., Luton, Beds. 583-19

FLIGHT Navigators required for Middle East operations, approximately May 3-June 23.; unrestricted British licence holders only. Apply in writing to Chief Navigator, Room 339, Overseas Aviation (C.I.), Ltd., Gatwick Airport, or phone, Livingstone 8811, ext. 6563. 583-17

SITUATIONS WANTED

COMMERCIAL pilot (28) with instrument rating and Flight Navigator's licence, 1,100 hours' world-wide airline experience, seeks post as company pilot to well-established firm operating singles or light twin aircraft (U.K. based) throughout Europe, Middle East or Africa. Box A833, care of THE AEROPLANE AND ASTRONAUTICS. 583-x3523

TUITION

AVIGATION, LTD., provides full time or postal tuition or a combination of these methods for M.C.A. Pilot-Navigator licences. Classroom instruction can be provided for A.R.B. General, certain specific types and performance schedule examinations, D4 Links. Phone, Rodney 8671. For details apply Avigation, Ltd., 30 Central Chambers, Ealing Broadway, London, W.5. Ealing 8949. zzz-771

DENHAM Link Training Centre, cost per hour £1 or 18s. for block bookings. Phone, Denham 2161 or 3171. zzz-789

EXETER AIR CENTRE offers the least expensive and most comprehensive flying training available today, contract rates from £3 7s. 6d. per hour. Normal Auster-Tiger rate £3 12s. 6d.; Chipmunk £5 5s. P.P.L. courses from £108 15s., C.P.L. from £665. Instructor's course from £72 10s. Special attention to individual requirements. Full Air Traffic Control. Radio aids. VHF-DF and 24-hour Met. service, grass or runways. Local accommodation from £3 10s. Airport £5 15s. 6d. Exeter Airport, Ltd., Exeter 67433. zzz-778

LEARN to fly, £32; instructor's licence and instrument flying for £4 per hour; night flying £5 per hour. Residence 6 gns. weekly. Specialized course for commercial pilot's licence. Wiltshire School of Flying, Ltd., Thruxton Aerodrome (Andover Junction 1 hr. 15 min. from Waterloo), Hants. zzz-788

Southend Municipal Flying School
offers comprehensive training (day and night) for commercial and private pilots in the environment of an international airport. No entrance fees. Airport Club available to members.
Austers £4.5s. solo; £4.15s. dual; contract rate £4. Chipmunk £5.10s. dual or solo.
Municipal Airport, Southend-on-Sea, Essex
Phone: Rochford 56204.

CROSS PERFECT PRECISION AIRCRAFT SPRING WASHERS
TO B.S. SPECIFICATION 2 SP.47
CROSS MFG. CO. (1938) LTD
COMBE DOWN, BATH. Tel.: Combe Down 2355

LONDON SCHOOL OF AIR NAVIGATION offers full-time personal coaching with home-study correspondence courses or combination of both for all aspects of professional pilot and navigator qualifications; also P.P.L. Officially appointed Services Courses Scheme. 33 Ovington Square, Knightsbridge, London, S.W.3. Ken 8221. zzz-792

THE COLLEGE OF AERONAUTICS.

APPLICATIONS ARE INVITED FOR THE
PERRING SCHOLARSHIP
IN
AERONAUTICS,
VALUED AT £500 PER ANNUM, TENABLE AT THE COLLEGE OF AERONAUTICS.

The successful candidate will be admitted to the two-year course in Aeronautical Science and Engineering at the College, leading to the award of the College Diploma (D.C.Ae.).

Applicants should preferably be honours graduates or final year undergraduates in engineering, mathematics or physics; applications from non-graduates with comparable qualifications will also be considered. Candidates must be British subjects domiciled in the United Kingdom.

Forms of application and statement of conditions will be forwarded on written application to:—

THE WARDEN,
THE COLLEGE OF AERONAUTICS,
CRANFIELD,
BLETCHLEY, BUCKS.

The closing date for the receipt of applications is June 1, 1961. 583-3

SURREY AND KENT FLYING CLUB, Biggin Hill (BN9) 2255. M.o.A.-approved course, Tiger and Hornet Moths, Chipmunk and Prentice. Contract rates. Route 705, one hour from Victoria. 583-0761

BOOKS AND PUBLICATIONS

"CAMERA IN THE SKY," by Charles Sims, with a preface by Air Chief Marshal Sir James Robb. For more than 30 years Charles Sims, chief photographer of THE AEROPLANE AND ASTRONAUTICS and one of Britain's best-known aerial photographers, has watched the amazing growth of British aviation from a ring-side seat. In this book he recalls with pen and camera, enlivened with anecdotes, some of his many memories of those eventful days. Illustrated. 218 pages, 25s. net from booksellers, or 26s. 6d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

"THE AEROPLANE" PICTORIAL REVIEW (No. 5). Staff of THE AEROPLANE AND ASTRONAUTICS. This fifth annual collection of outstanding aviation pictures contains over 200 photographs grouped in 12 sections and descriptively captioned. Illustrated, 128 pages, 12s. 6d. net from booksellers, or 13s. 7d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. Other volumes available in this Series: THE AEROPLANE Pictorial Review, No. 3, 10s. 6d. net (post free 11s. 7d.). THE AEROPLANE Pictorial Review, No. 4, 12s. 6d. net (post free 13s. 7d.). All other volumes in this Series are now out of print. zzz

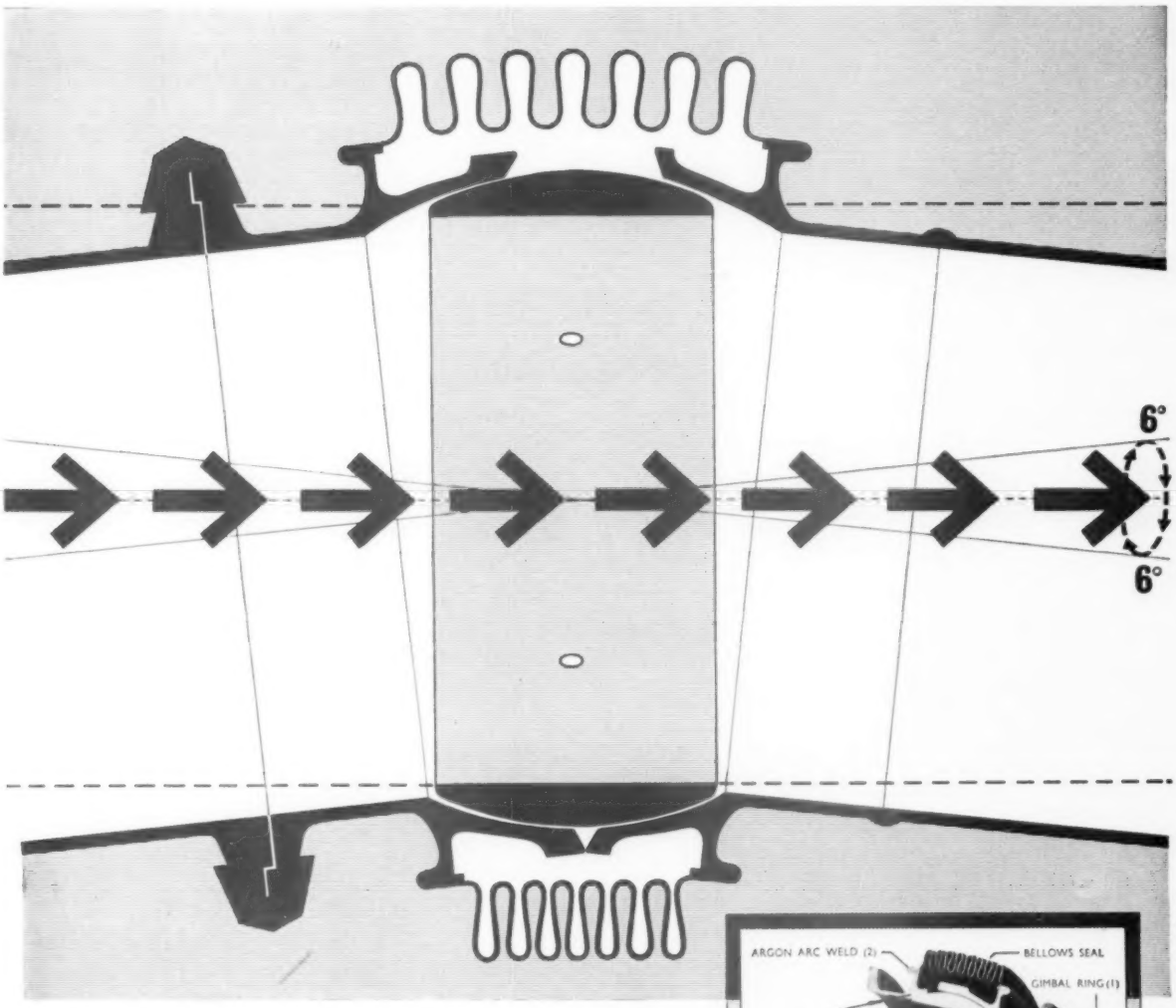
THE "POWER AND SPEED" SERIES FOR BOYS. "Aircraft and Air Power," by F. G. Swanborough, of THE AEROPLANE AND ASTRONAUTICS, has been written for intelligent boys between the ages of 10 and 16. The author surveys modern military flying and includes chapters on combat aircraft, scientific aids and missiles. Other titles in this Series are "Motorcars," "Locomotives" and "Ships and Shipbuilding." Illustrated, 112 pages, 10s. 6d. net from booksellers, or 11s. 5d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

PRINCIPLES OF HELICOPTER ENGINEERING, by Jacob Shapiro. This comprehensive review of the engineering principles governing the design and construction of helicopters provides a complete survey of recent knowledge in the field. Illustrated. 448 pages, 55s. net from booksellers, or 56s. 9d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

INDEX TO ADVERTISERS

Name	Page
A	
Aero American Corporation	16
Aero-Enterprises (Boreham Wood), Ltd.	16
Airline Air Spares	17
Airwork Services, Ltd.	17
Avica Equipment, Ltd.	Inside Back Cover
B	
British Aircraft Corporation, Ltd.	9-12
British Airline Pilots Association	18
British European Airways	19
British Executive & General Aviation Ltd.	15
C	
Campbell, D.	17
Central Office of Information, Royal Air Force Recruiting	18
Clifford, Peter, & Co., Ltd.	17
Cross Manufacturing Co. (1938), Ltd.	18, 20
Cunard Eagle Airways, Ltd.	18
D	
Decca Radar, Ltd.	4
H	
Hawker Siddeley Aviation, Ltd.	Front Cover, 8, 19
J	
Jeppesen & Co., GmbH.	6
L	
Lucas Gas Turbine Equipment, Ltd.	Back Cover
M	
Marconi's Wireless Telegraph Co., Ltd.	14
P	
Plessey Co., Ltd., The	Inside Front Cover
R	
Robinson, L., & Co. (Gillingham), Ltd.	6
S	
Shackleton, W. S. (Aviation), Ltd.	16
Short Brothers & Harland, Ltd.	1, 17
Simmonds Aerocessories, Ltd.	2, 3
Southend Municipal Flying School	20
Stream-Line Filters, Ltd.	7
U	
United Aircraft Export Corporation	5
V	
Vigors Aviation, Ltd.	17
W	
Westland Aircraft, Ltd.	13

Printed in England and Published Weekly by the Proprietors, TEMPLE PRESS LIMITED, BOWLING GREEN LANE, LONDON, E.C.1.
Registered at the G.P.O. as a Newspaper. Second class postage paid at New York, N.Y. Registered for transmission to Canada and Newfoundland by magazine post. Annual Subscription Rate United Kingdom 95/-, other countries 100/- (Canada and U.S.A. $15) postage included. Shorter periods pro rata. AGENTS ABROAD—EUROPE—Messageries Dawson (S.A.), Paris; Messageries, Hachette et Cie., Paris; W. H. Smith & Son, Paris and Brussels. CANADA—Wm. Dawson Subscription Service, Ltd., Toronto; Gordon & Gotch, Ltd., Toronto. U.S.A.—Eastern News Co., 306 West 11th Street, New York, 14, N.Y. AFRICA—Central News Agency, Ltd., Cape Town; Wm. Dawson & Sons (S.A.), Cape Town. ASIA—W. Thacker & Co., Ltd., P.O. 190, Bombay. AUSTRALIA and NEW ZEALAND—Gordon & Gotch (A'sia), Ltd.



flexible stability

Avica-flex gimbal-type flexible joints provide stability in high-performance ducting systems, controlling expansion and relative movement, off-loading strain from ducts, couplings and supports. There are different types for handling angular, axial or lateral offset movement, or combinations of these. They are of stainless steel construction with only two welds in assembly. Suitable for temperatures up to 500 C (932 F) at pressures up to 250 p.s.i. (17.6 kg/cm²), standard sizes range from ¾" (22.2 mm) to 12" (304.8 mm). Avica-flex gimbal-type flexible joints are just one of many Avica components built for piping and ducting systems.

AVICA-FLEX

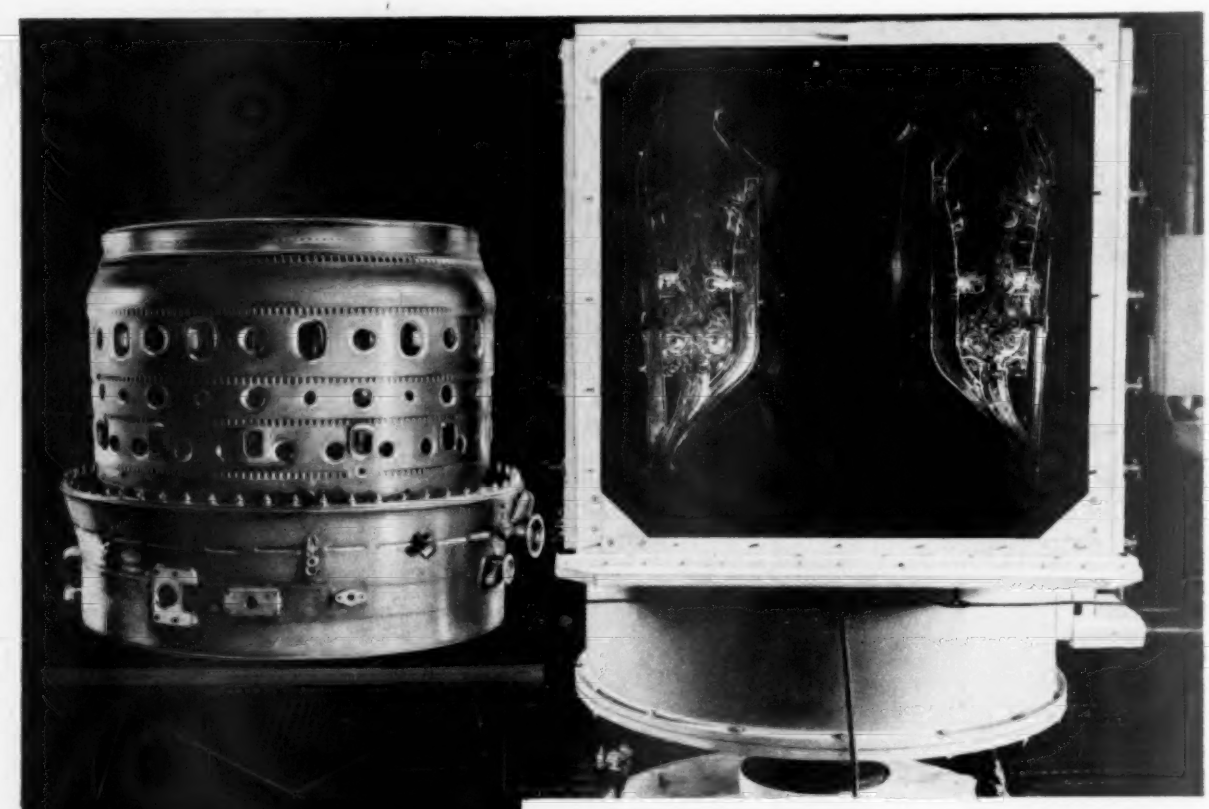
Gimbal-type flexible joints

AVICA EQUIPMENT LIMITED, Mark Road, Hemel Hempstead, Herts. Tel. Boxmoor 4711 (6 lines)

AVICA INTERNATIONAL, 3 rue du Temple, Geneva, Switzerland. Tel: Geneva 32.88.00

Visit us at the Paris Air Show on the Stand of our licensee ABG

TA-4371

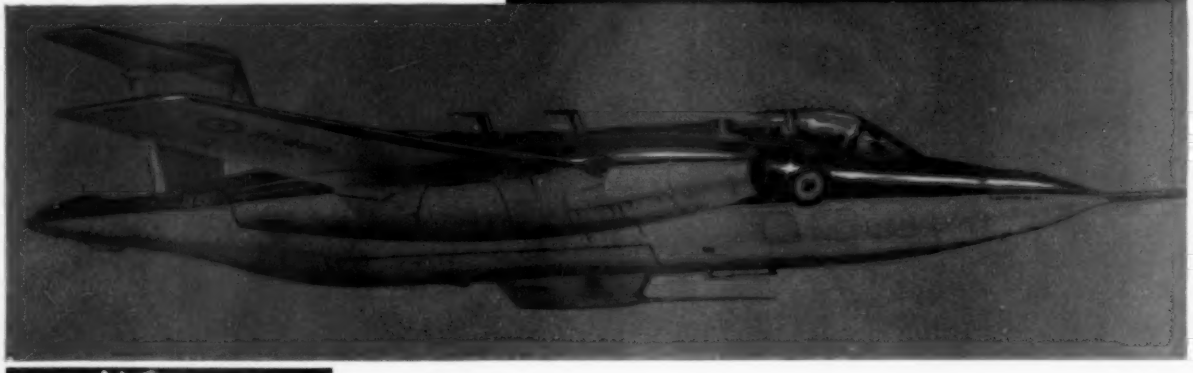


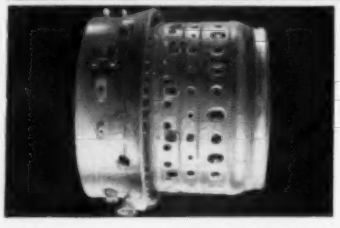
FROM LUCAS CARE-

THE FLUID FLOW LABORATORY at Burnley is used to determine the flow pattern under operating conditions. Tracer air is injected into water, which circulates through a Perspex model of the equipment under examination. With illumination the bubbles give a three-dimensional view of the flow pattern. The model shown is the Annular Combustion Chamber for the Buccaneer.

DE HAVILLAND ENGINES LTD., a division of the Hawker Siddeley group, choose Lucas-designed combustion equipment.

STEMS LUCAS ACHIEVEMENT





Annular Combustion Chamber incorporated in the Blackburn Buccaneer.

Lucas Gas Turbine Equipment Ltd., Birmingham & Burnley
Lucas-Rotax (Australia) Pty., Ltd., Melbourne & Sydney, Australia
Lucas-Rotax Ltd., Toronto, Montreal & Vancouver, Canada

LUCAS

FUEL AND COMBUSTION SYSTEMS FOR GAS TURBINE AND RAM JET ENGINES